DOCUMENT RESUME

ED 252 990 EC 171 323

TITLE	Behavioral Strategies for Psychological Intervention.
INSTITUTION	Iowa State Dept. of Public Instruction, Des Moines. Div. of Pupil Personnel Services.
SPONS AGENCY	Drake Univ., Des Moines, Iowa. Midwest Regional Resource Center.
PUB DATE	80
NOTE	246p.
PUB TYPE	Guides - Non-Classroom Use (055)
EDRS PRICE	MF01/PC10 Plus Postage.
DESCRIPTORS	*Behavior Change; *Behavior Modification; Contingency Management; *Disabilities; Elementary Secondary Education; Punishment; School Psychologists; Timeout

ABSTRACT

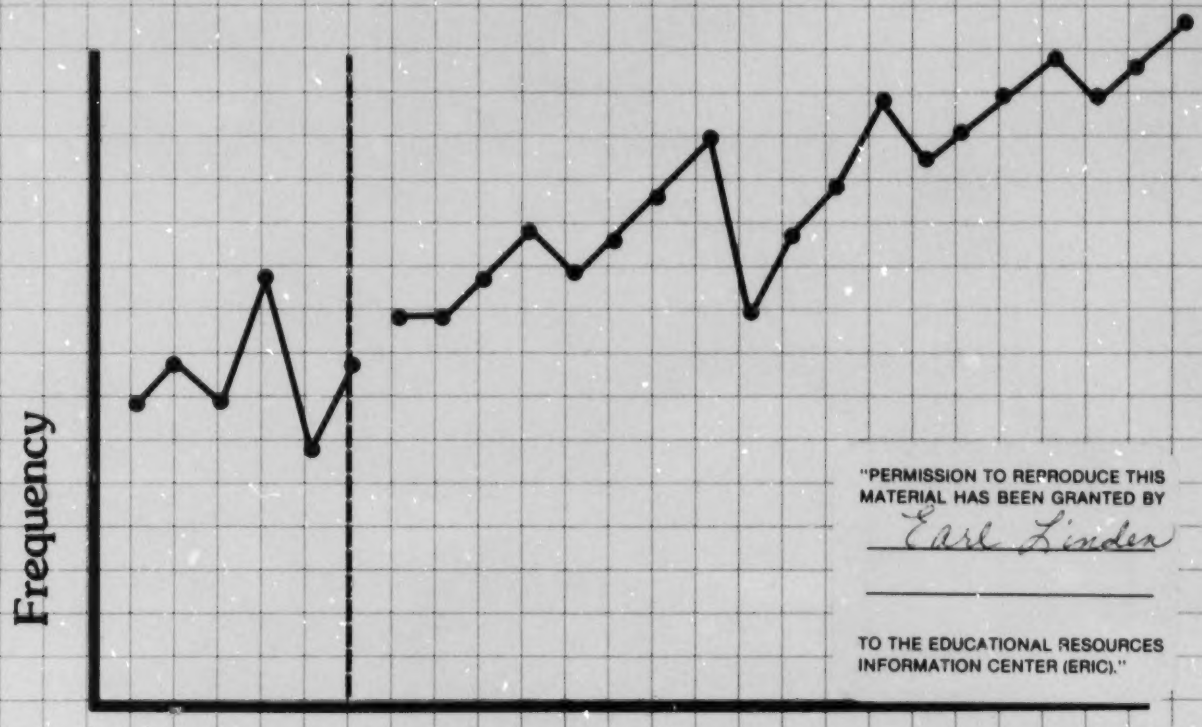
Ten papers contributed by school psychologists or university educators working with school psychology programs review psychological theory and research on behavioral strategies for psychological intervention. Following an overview on the effective use of behavior modification in the school, nine behavior change methods are examined in terms of research, underlying theoretical principles, guidelines for the application of the procedures, and illustrative case examples. The following methods are considered: the Premack Principle (making a higher probability event contingent on the performance of a lower probability behavior), differential reinforcement of low rates, modeling-based interventions, precision teaching, differential reinforcement of other behavior; satiation, negative practice and overcorrection; timeout; punishment; and extinction. (CL)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

ED252990

Behavioral Strategies for Psychological Intervention



"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Earl Linden
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

EC 17 333

Iowa Department of Public Instruction

State of Iowa
DEPARTMENT OF PUBLIC INSTRUCTION
Grimes State Office Building
Des Moines, Iowa 50319

STATE BOARD OF PUBLIC INSTRUCTION

Susan M. Wilson, President, Waterloo
Robert G. Koons, Vice-President, Clinton
William N. Cropp, Des Moines
Jolly Ann Davidson, Clarinda
Karen K. Goodenow, Wall Lake
Mary E. Robinson, Cedar Rapids
John E. van der Linden, Sibley
Harold R. Yeoman, Monticello
Vacancy

ADMINISTRATION

Robert D. Benton, State Superintendent and Executive Officer
of the State Board of Public Instruction
David H. Bechtel, Administrative Assistant
James E. Mitchell, Deputy State Superintendent

Pupil Personnel Services Branch

Drexel D. Lange, Association Superintendent
J. F. Vance, Director, Special Education
Jeff Grimes, Consultant, School Psychological Services

Table of Contents

	Page
The Effective Use of Behavior Modification in the School By W. Scott Wood	1
The Premack Principle: How it can be Applied to Change Behavior in Educational Settings By Rosemary Morris	11
Differential Reinforcement of Low Rates: The Problem of Applying Theory to the Classroom Situation By Philip B. Bowser	33
Modeling-Based Interventions with Children By Frank M. Gresham	65
Percision Teaching: A Behavioral Approach to the Assessment of Learning By James P. McLallen and David Schoemer	111
Differential Reinforcement of Other Behavior By George G. Bear	141
The Appropriate Use of Satiation, Negative Practice and Overcorrection Procedures By Mark Shepp	171
Timeout: Guidelines for the School Psychologist By Joe Meyers	195
Punishment By Phil Duncan	207
Extinction: The Ends and Means of Ignoring By Rebecca Barloon-Noble	227

AUTHORS

Becky Barloon-Noble
School Psychologist
623 Miramonte Drive
Santa Barbara, California 93109

George G. Bear, Ph.D.
School Psychologist
Heartland AEA
120 South Hazel
Ames, Iowa 50010

Philip B. Bowser
School Psychologist
Roseburg Public Schools
1419 N.W. Valley View Drive
Roseburg, Oregon 97470

Phil Duncan, Ph.D.
Psychology Department
Drake University
Des Moines, Iowa 50311

Frank Gresham, Ph.D.
Psychology Department
Iowa State University
Ames, Iowa 50011

James McLallen, Ph.D.
School Psychologist
Mississippi Valley AEA
Building #8
2604 N. 4th Street
Clinton, Iowa 52738

Joe Meyers, Ed.D.
Supervisor, School Psychological Services
Heartland AEA
1932 S.W. Third
Ankeny, Iowa 50021

Rosemary Morris
School Psychologist
Grant Wood AEA
4401 6th Street, S.W.
Cedar Rapids, Iowa 52401

Mark Shepp
School Psychologist
Northern Trails AEA
P.O. Box M
Clear Lake, Iowa 50428

David Schoemer
Mississippi Valley AEA
Building #8
2604 N. 4th Street
Clinton, Iowa 52738

W. Scott Wood, Ph.D.
Psychology Department
Drake University
Des Moines, Iowa 50311

FOREWORD

School Psychology is an applied science devoted to helping children, parents, teachers, administrators and others provide environments which protect and promote mental health and facilitate learning. In carrying out this charge school psychologists utilize a body of knowledge, based upon psychological theory and research, to assist children, parents and educators solve problems in the home and school setting. This publication is designed to review psychological theory and contemporary research regarding a selection of behavioral strategies for psychological intervention.

All of the authors who contributed to this publication are school psychologists or university educators working with school psychology programs. The intent of the publication is to provide an update on research, clarify the theoretical principles for each behavior change method, present guidelines for the application of the procedures and illustrations of case examples pertinent to the school psychologist's work. Consideration is given to procedures for accelerating and decelerating the occurence of behaviors.

Appreciation is extended to the Midwest Regional Resource Center for partial funding of this project, to Marcia Olson, information specialist in the Iowa Department of Public Instruction (DPI) who reviewed all manuscripts and made valuable suggestions and to Phyllis Marshall, Compositor in the word processing center in the DPI, who typed all of the chapters of this publication.

Jeff Grimes, Consultant
School Psychological Services
Iowa Department of Public Instruction
Grimes State Office Building
Des Moines, Iowa 50319

The Effective Use of Behavior Modification in the School

by

W. Scott Wood
Drake University

The field of behavior modification is scarcely 20 years old. The term itself did not even appear until the mid 60's. Nevertheless, most of today's college textbooks on educational methods contain at least a section on behavior modification, which is especially true if the emphasis is special education. In addition, workshops and inservice programs on basic techniques are provided so that even those teachers whose formal education preceded the advent of behavior modification have many opportunities to catch up. Such a rapid rise in visibility and, presumably, use suggests that the behavioral approach has something important to offer all educators. Unfortunately, the technology of behavior control still is not being used, nor, for that matter, is it well understood by educators.

Like any applied science, behavior modification is based upon a set of underlying concepts and principles that are the result of years of laboratory research, in this case, research with the behavior of rats, pigeons, and monkeys. Unfortunately, few educational texts or workshop instructors discuss this basic behavioral science when presenting strategies of behavior modification to educators. Perhaps the authors and instructors believe that emphasis on animal research seems irrelevant, too difficult, or links the field too closely to the theories of B. F. Skinner, an admittedly controversial figure in an era of "humanistic" education.

A failure to appreciate an essential continuity between the basic science of behavior and behavior modification can have the effect of reducing behavior modification techniques to a set of "tricks" in a teacher's or a consultant's bag of educational methods. That is a serious error because behavior modification is more than a set of potentially useful classroom management methods. It is a sophisticated and comprehensive technology of behavior analysis and control, based upon both a science and a philosophy of human behavior.

The behavioral practitioner, whether a school psychologist, special educator or teacher, who really understands the theoretical and empirical integrity of that science is going to be better able to analyze classroom problems and recommend effective solutions than will the person for whom "B-Mod" is simply another set of standardized gimmicks once heard at an inservice. This doesn't mean that some of those gimmicks won't work. They often do. Rather, the more one views classroom situations from a behaviorally scientific frame of reference, the more likely he or she will deal with them successfully. This is true in any field

that has a basic science as its foundation. The electrician who knows something about basic electronics is going to be a more effective diagnostician and repairman for a malfunctioning piece of stereo equipment than someone who simply replaces parts until it starts working again. Unfortunately, it is not all that easy to become a complete behaviorist, even though a behavior modifier who makes an effort to do so is going to be more successful than those who don't. Certainly reading a chapter in a book won't do it. Nevertheless, important elements of the behavioral approach can be summarized so the practitioner can at least appreciate behavior modification from the proper scientific perspective.

One must begin by stating the fundamental assumption which underlies the science of behavior and which governs the field of behavior modification: <u>All behavior is determined by either inheritance or experience</u>.

Inheritance generally refers to biological characteristics of a species as selected by evolutionary pressures, while experience refers to the behaviorally shaping effects of an organism's contacts with the environment throughout its lifetime. This means that there is no autonomous, in-dwelling, non-physical source of "will" which is capable of exercising free choice over ways to behave in either animal or man. Efforts to attribute behavioral causality to such sources are both inaccurate and misleading.

Now this is fairly stern stuff, but you don't become a scientist, behavioral or otherwise, unless you are willing to state and hold some quite strict deterministic assumptions about the subject area you are going to study. To discover and make scientific or technological use of scientific orderliness, you must begin by assuming that such orderliness exists in the first place. There is no point to the study of molecules, monkeys or man if you approach them with the underlying suspicion that they are really free to act in any way in which they choose.

A deterministic assumption about man's inherent controllability as a biological organism may seem a little distasteful to nonscientists, just as Darwin's statements about man's place in evolution seemed offensive to many people a century ago and even to some today. Unfortunately, it is science's basic strategy to challenge the unknown by assuming and seeking a natural order of things. The seeming unpleasantness of some of these theories are usually balanced by the scientific progress that results. A society which rigidly held that the earth was flat never would have discovered the new world.

The next two points do not reflect philosophic commitments to the natural science approach, but rather are the principal results of about 50 years of research and theorizing by behavioral psychologists:

Most important human activities are controlled by their environmental consequences. Positive consequences strengthen behavior (reinforcement) and aversive ones weaken behavior (punishment).

Subjective events, such as beliefs, emotions, attitudes, thoughts, feelings and so forth do not directly influence behavior. They are themselves by-products of enviromental events.

These two statements essentially summarize the basic principles which have been found by behavioral psychologists to operate in controlling human behavior. Generally speaking, the things that do control behavior lie in the person's environment, principally in the consequences which follow given activities, while the things that do not control behavior, regardless of how they appear to the individual, are things going on inside the organism. It scarcely needs saying that there are some alternative, even diametrically opposing views on this subject that are held by many psychologists and educators, to say nothing of philosophers and politicians.

To summarize, a behaviorist is one who knows that behavior modification is the technological end-product of the scientific study of behavior. This science is founded on the assumption that there is a natural orderliness in behavioral events, an assumption which has resulted in the discovery and repeated affirmation of the knowledge that environmental events control actions. The other side of that perspective is that subjective events, things said to be going on inside the organism, do not affect behavior in the ways that most people assume that they do. People act as they do largely because of the way they have been reinforced for acting and their behavior will change if those reinforcing contingencies change. People do not act because of their feelings, beliefs, attitudes, emotions, or will power. Those private events, to the extent that they exist at all, are equally the result of a person's environmental history, and simply stand between the environment and behavior. You change them the same way you change behavior, by directly altering the environment.

What are the implications of emphasizing the scientific logic of the behavioral approach for the behavior modifier? There are several:

1. It provides an appropriate definition for the role that a behavior modifier plays in any applied setting. He or she is a **behavioral engineer**, one who makes technological use of basic principles of behavior control to alter a client's behavior in desired ways. You may effect that behavior change by working directly with a client, such as a student, or you may produce a change by working through an agent, such as a parent or teacher. In either case, it is important for the behavior modifier to acknowledge and accept the responsibility for intentionally manipulating the behavior of others.

This means, of course, that you are open to evaluation as to how effectively you can produce behavior change. The popular term for this is "accountability" and, in the abstract, everybody seems to be for it. Nevertheless, many professionals do not like to have their own performance standards quite so clearly established. The behavior modifiers, however, have no choice. They are defined in terms of their ability to control behavior.

2. Another implication concerns the strategy, the overall game plan, that a behavior modifier adopts in analyzing behavioral problems. Briefly, the strategy is to view the entire situation from the perspective of behavioral science. One seeks to analyze a client's behavior by examining the existing reinforcing contingencies. One seeks to change the behavior, if that is called for, by altering those contingencies or by introducing new ones. Generally, this will involve establishing an objective record of the behavior in question, a record which will be kept while efforts to alter the behavior are implemented and evaluated. This book, of course, will attempt to describe several of those methods and how to use them. However, it is important for the behavior modifier to learn what to ignore as much as learning what to watch for.

As discussed earlier, the behavior modifier will not rely extensively on a client's subjective condition as the measure of a problem, nor seek to directly alter that condition as a means of solving the problem. A student who fails to complete homework as a "failure to complete homework" problem, not one of motivation. A child who doesn't play with others or doesn't talk much needs to become more interactive, not to develop a better "self-concept."

The technology of the behavior modifier is focused on managing overt behavior and this task is best defined in such terms. This does not mean that terms which appear to refer to inner states cannot be behaviorally analyzed. Behaviorism doesn't ignore a subjective life as much as it questions its relevance as a source of meaningful behavior control.

3. Like any other applied science, behavior modification is neither easy to learn nor simple to apply. A recent survey conducted by Drake University reveals that among the major university training programs, the average number of graduate hours required for a masters degree in applied behavior analysis is 42. There is also a strong emphasis on supervised practicum experience in all these programs. This attests to the fact that, like any other engineering field, a thorough working knowledge of the theoretical and technological implications of basic principles requires extensive instruction and experience. Unfortunately, few in the field of education are familiar with the large and growing body of literature in behavioral psychology. For many, behavior modification remains a catchword for a few simple techniques.

This recognition of behavior modification as an applied science carries a further implication in that there are correct and incorrect ways to go about implementing its principles. In other words, there are right and wrong ways to do anything in a technological field. Analyzing and treating behavior problems simply is not an "art", nor is there any conspicuous merit in maintaining an eclectic approach or seeking out and using only those methods with which the practitioner feels personally comfortable. Try to envision an applied science whose principles are subject to individual approval by its engineers and technicians. Suppose, for example, that it was acceptable for aeronautical engineers to use only those safety and design principles they personally enjoyed working with and to ignore others because they were difficult to use or hard to learn.

To make this point clear, there is no real compromise between a behaviorally scientific approach and those less empirical strategies which are always around, always popular, and never evaluated. This does not mean that someone needs to be able to describe his or her skills in behavioral terms in order to be effective. The ability to use reinforcement certainly has existed longer than has the scientific expression of the concept. Still, to the extent that one is effective in dealing with behavior, the generic behavior control processes are operative whether the person who can use them is able to describe them as such or not. Historically, it was possible to build some rather complex structures before the principles of mechanics were elaborated, but not as well as engineers can today. There is certainly no virtue in remaining ignorant of a scientific account when one exists that can be depended upon.

4. A fourth implication of recognizing the role of behavior modification as part of a larger science of behavior is accepting the fact that behavior modification probably won't have a solution to every possible problem. Likewise, contemporary medicine cannot cure all of today's ailments. Science simply doesn't provide immediate solutions to all problems. Nevertheless, only science is likely to provide any solutions, now or in the future. To a behavior modifier, this means that the only sensible approach to a classroom problem is going to be a behavioral one, and if your efforts fail, they will have failed for behavioral reasons. In many cases, such failures are due to nothing more than a lack of control necessary to effect a solution. Knowledge of the relevant factors isn't by any means the same thing as being able to control them all the time.

Thus, a behavior modifier applies the principles of behavior until his or her behavioral knowledge is exhausted. You simply do not conclude that "reinforcement" does not work the first time a youngster tells you he is not about to study for gold stars or M & M's. No basic set of scientific principles established and affirmed by decades of basic and applied research is going to be upset by the occasional failure of someone to use them correctly. Ineffective behavioral programs reflect ineffective behavioral programmers, nothing more.

5. Finally, and in many ways, most importantly, behavior modifiers as behavioral scientists must recognize that their own behavior is as subject to the laws of behavior as are the behaviors of their clients. Skinner has always acknowledged this situation by stating that his behavior has been as controlled by his animal subjects in research as their behavior has been controlled by him. This simply means that the analytical and management skills of the behavior modifier are shaped by their consequences. Recognizing this state of affairs raises several points for the behavior modifier to consider.

First, you can deliberately arrange to improve the ways that your own behavior is controlled by making effective use of the principles of reinforcement. For example, if you want to be maximally controlled by the student's behavior in order to detect small changes in its appropriate (or for that matter, inappropriate) direction, then you had better be the classroom observer, not someone else. Of course, all situations may not call for such a fine-grained analysis, and rather gross measures such as "out-of-seat" behavior may suffice. In such cases, you may only need to respond to records kept by someone else. Still, many subtle kinds of problems call for the behavior modifiers to place themselves directly in the relevant behavioral environment. These are situations in which the behavior analysts must first do the learning, so it is important that they be under the control of the right variables.

There is another side to this coin. It also is possible for behavior modifiers to be reinforced inappropriately and thus come to misuse or not use their skills as they have been trained to do. One of the points discussed earlier was that of the behavior modifier's professional responsibility or accountability and how it is judged in terms of effectively controlling behavior. Clearly this suggests that behavior modifiers ought to be reinforced for their skills as behavior change agents. Unfortunately, there are reinforcement contingencies in the educational system which can shape the behavior modifier to behave otherwise.

Testing. Special education legislation has established an elaborate incentive system to identify youngsters whose educational and social behaviors are difficult to manage in a conventional classroom. Basically the laws provide additional money and personnel to school districts which have a quota of such problem students identified and ready for special treatment. There is no equivalent incentive for correcting these problems (should they really exist) and for sending the students back to their regular classes, nor for keeping them there in the first place.

Thus it should not be surprising that administrators are often very concerned with finding problem students and making sure that they have been labeled in a fashion which meets the state's

criteria for funding. However, these same administrators often express considerably less concern about how well the programs actually work. This can lead to considerable administrative pressure or all resource personnel to spend as much time as possible on diagnostics, at least until the upper limit of funding is reached for their special education programs. Certainly the behavior modifier who is spending every waking moment giving tests will have little opportunity to design behavior change programs. Unfortunately, there is no simple solution to this situation, at least within the practical constraints of the professional's working environment, but one can at least be alert to the problem.

Non-Behavioral Treatment. Another sort of behavioral trap lies in the fact that it is almost always easier to do anything but behavior modification and call it therapy. Behavior modification requires time, data, special arrangements for reinforcement, often the training of teachers and parents, and so forth. Many other popular educational or psychological treatments are considerably easier to apply. They usually do not work, but they are a lot easier and sometimes even fun and, as noted above, many administrators do not reinforce for program effectiveness anyway. For instance, projective tests are easier to give and a lot more exciting to interpret, particularly for teachers, then are obtaining records of the frequency with which a youngster does classwork correctly. Since you have to test anyway, you may as well do something that can take place in an office. (Besides, you will really sound like a professional if you can make the problems seem Freudian rather than a matter of how the teacher is reinforcing students for classroom behavior.)

It also is a real temptation to "counsel" students as opposed to designing and implementing classroom behavior management systems. After all, talking to students and parents requires little or no effort or even professional training. In fact, if you adopt a Rogerian approach, you mostly listen anyway. You can even put groups together and spread your expertise around. (Be sure before you adopt this strategy that there is no existing objective definition of the student's problem against which your "treatment" can be evaluated. The best way to assure this is to argue that it isn't a behavioral problem anyway, but one of deeper and more mysterious origin within the psyche.)

Consulting. Another way to make your work easier (and still keep your reputation as a behaviorist) is to become a consultant to, rather than an implementor of, behavior treatment programs. In this role, you attempt to solve classroom behavior problems either by teaching others how to use behavior principles to solve problems on their own or by designing behavior modification programs which then become the responsibility of someone else to implement. And, unlike the situations described above, this is an approach which might have some positive effect if it is done correctly. To do this well requires that the behavior modifier

approach this kind of management system as systematically as he or she approaches a classroom problem. This will require you to set up a behavior modification program that focuses upon the behavior of the intermediary, including all the encumbered measures and methods. However, it is very easy not to put the necessary time and effort into working with teachers, and instead to rely upon simple instruction and explanation as the tactic for developing the skill they will need for your "consulting" to work. When the program fails, as it is almost certain to do under such circumstances, the teachers usually blame the strategy as well as the consultant and thus there is a double loss, both to your own credibility and to the field as a whole.

In conclusion, behavior modifiers who are alert to such inappropriate sources of reinforcement should tie the assessment of their own performance to their opportunities to effectively work as behavior change agents. If nothing else, keep an objective, visible record of your behavioral casework and be willing to discuss, perhaps even publish, your experiences. In the last analysis, if you find yourself out there alone, possessing a behavioral philosophy which is socially unpopular, working hard at recording and reinforcing the behaviors of students and teachers, arguing with humanistic or psychoanalytic colleagues, regarding professional accountability, getting administrators to acknowledge what you do best and letting you do it, and running around with a lot of graphs that few people in the school can even read, let alone appreciate, welcome to the field.

Be assured that such activities are not wasted. Some students will become better learners, some teachers will acquire more effective teaching and management skills, and occasionally one of your non-behavioral colleagues may become a little interested in being more effective. Finally, your successes will help to create an environment where similar approaches will be more likely to be used in the future. Galileo, when forced to recant his heretical belief that the earth revolves around the sun, was overheard to mutter, "But it moves." Today's behavior modifier often faces a similar climate of doubt regarding the benefits of a science of behavior. They have an equally correct observation, "But it works."

The Premack Principle:

How It Can Be Applied to Change Behavior in Educational Settings

by

Rosemary Morris
Area Education Agency 10

Introduction

Behavior modification techniques have become increasingly popular in educational settings in recent years. Research evidence has rapidly accumulated demonstrating that the principles of reinforcement are applicable to "managing, modifying, building and maintaining behaviors" of a student. (Yawkey and Griffith, 1974, p. 59). However, some behavior change programs are more successful than others.

One of the most crucial elements determining if a program will succeed in changing behavior is the reinforcer selected for use with a child. Identification of effective rewards is difficult because of the individual differences among children in their responsiveness to reinforcers. Psychologists have often assumed the universal applicability of such rewards as teacher approval, letter grades or candy only to find that these stimuli are unable to promote behavior change.

Possibly, the easiest and most efficient procedure for selecting reinforcers is to look at the relative frequencies of the child's present behaviors. What is she spending most of her time doing? The idea is that an activity which the child is likely to perform can be used to reinforce an activity in which she is less likely to engage. This notion has been referred to as "Grandma's Rule" which states, "first you work, then you play; or you do what I want you to do before you get to do what you want to do." (Rimm-Masters, 1979, p. 171).

A variation of this view of reinforcement has been formalized and researched by David Premack (1959) and is commonly referred to as the Premack Principle. In short, the principle states that a behavior that has a high probability of occurring can be used to reinforce a behavior that has a lower probability of occurring if the higher probability event is made contingent upon the performance of the lower probability behavior. (Premack, 1959).

It is the purpose of this chapter to examine Premack's analysis of reinforcement and how it can be applied to changing behavior. Premack first published his principle of reinforcement in a 1959 Psychological Review article. He has followed this up with refinements of his generalization. (Premack 1965, 1971). Premack has conducted most of his research using animals as subjects. However, many other experimenters have tested his hypothesis with human subjects in laboratories, clinics and classrooms.

Since this chapter was written primarily for school psychologists, it focuses upon educational applications of the Premack Principle backed up by research data whenever possible. It begins with a comparison between the Premack Principle and the more traditional view of reinforcement. This section is followed by a brief literature review. The bulk of the chapter is devoted to procedures for using the principle along with practical illustrations. The chapter ends with a look at the positive aspects and limitations of Premack's account of reinforcement.

It is hoped that when psychologists have finished reading, they will have another tool at their disposal with which to modify behavior, or at least a method which can be combined with other behavior change techniques to make them more successful.

Premack Principle and the Traditional Definition of Reinforcement

Premack's definition of a reinforcer differs considerably from the traditional definition which states that a reinforcer is any stimulus that follows a response which produces a change in the frequency of that response. In line with this definition are three general assumptions that are included in the standard account of reinforcement (Premack 1965).

First, according to the traditional view, there are some stimuli that are able to function as reinforcers and others that are not. Secondly, according to the standard definition, reinforcers are trans-situational (Meehl, 1950). That is, a stimulus that functions as a reward for one response will also function as a reinforcer for all other responses. Finally, the traditional account of reinforcement assumes that there are two types of responses, "one that is reinforcing but not reinforceable, another that is reinforceable but not reinforcing. (Premack, 1965, p. 130). Consequently, consummatory responses such as eating or drinking were used only as reinforcers, never as responses to be reinforced.

Premack has challenged the validity of these assumptions. He looks upon reinforcement as a relative property of a response stating that "the most probable response of a set of responses will reinforce all members of the set; the least probable will reinforce no members of the set." (Premack, 1965, p. 132). Furthermore, responses of intermediate probability are able to act as reinforcers for those responses less probable than themselves, but not for those more probable than themselves. (Premack, 1965).

To clarify, a person takes part in many activities that differ in their intrinsic value for him, for example, watching TV, playing tennis and reading. Let's say that the person's relative

preference for each of these activities (measured in terms of the time he spends engaged in each of them when he has free time) has been determined. Playing tennis is most preferred since he spends more of his free time devoted to this sport than reading or watching TV. Reading is ranked second and watching TV is his least preferred of the three activities.

According to Premack's research data, a particular event or activity will reinforce events of lesser value to the person but not those of higher value. Therefore, in the tennis-greater-than-reading-greater-than-watching-TV ranking, it can be expected that playing tennis would reinforce (increase) reading or watching TV if it was made contingent upon performing these behaviors. Reading would act as a reinforcer for watching TV since it is a more highly preferred activity than watching TV, but reading would not act as a reinforcer for playing tennis since it is a less preferred activity than playing tennis. In this situation watching TV would not serve as a reinforcer for either playing tennis or reading since it is the least preferred of the three activities.

However, if the same person were placed in another situation in which he was free to choose between watching TV or doing crossword puzzles; and he spent more time watching TV than working the puzzles, it would be assumed that watching TV was the more preferred activity. According to Premack, in this setting watching TV would be an effective reinforcer for working crossword puzzles if it were made contingent upon doing the puzzles.

Thus, whether an activity is or is not a reinforcer depends upon its position in the hierarchy of value for the individual relative to the event upon which it is contingent. It cannot be said that some events are always reinforcers and others are not.

A final difference between Premack's account of reinforcement and the traditional view is that the latter emphasizes the nature of the reinforcing stimulus (e.g. food, money, stars). Premack speaks in terms of the reinforcing response (eating, playing, reading, etc.) stressing that under certain conditions almost any activity will serve as a reinforcer. Children who prefer playing a game over eating will eat in order to be able to play the game, whereas children who would rather eat than play will increase their number of playing responses to gain access to food. (Bandura, 1969).

Literature Review

Premack and his students have conducted a considerable amount of research using a variety of subjects and response measures both in the laboratory and field situations. The aim of most of Premack's experiments has been to show that any activity or event, particularly those not usually thought of as rewards, can serve as a reinforcer when it is made contingent upon events or activities even lower in the subject's hierarchy of value. (Rachlin, 1976).

An example of a typical experiment conducted by Premack (1959) was carried out using a Cebus monkey as a subject. The purpose of the experiment was to show that one instrumental response or activity could be used as a reinforcer for another activity if the first activity occurred at a higher independent rate than the response to be reinforced. The events used as reinforcers were manipulation responses. The three responses were lever pressing, operation of a horizontally hinged door and a bin response in which the animal pushes back a light door mounted behind a hole and contacts an empty bin. A panel in the monkey's cage held all three manipulanda. The animal's probability of engaging in each of these responses was determined during baseline observation sessions by allowing the monkey to engage in each response as much as he desired during five to ten 90 minute sessions. The monkey averaged 20 responses for the bin, 50 for the lever and 100 for the door.

Premack first tried using level pressing (a lower probability behavior) as a reinforcer for operating the door (a higher probability behavior) by making access to the lever contingent on first opening the door. During these sessions the door averaged about 80 responses and the lever only 22; demonstrating that the lower rate response cannot be used to increase the rate of a higher probability response. However, when Premack made operating the door contingent upon pressing the lever, the average number of lever presses was 120; showing that a higher rate response is a very effective reinforcer for a lower rate response.

Many other animal studies have been carried out to test the Premack hypothesis (Premack, 1959, 1962, 1963, 1965, 1971; Premack and Premack 1963; Premack, Schaeffer and Hundt, 1964; Hundt and Premack, 1963).

An experiment conducted by Premack (1959) using children as subjects not only demonstrates that a high probability response can serve as a reward for a lower probability response, but also that consummatory responses can be reinforced. That is, eating is not always the reinforcer; it can be the response that is reinforced. This refutes the traditional notion that there are some events that are reinforcers and some that are not.

Thirty-three children, average age 6.7 years, were put in an experimental situation in which a pinball machine (PBM) and a candy dispenser were placed side by side. The candy dispenser delivered chocolate bits one at a time on a conveyer belt. As the child ate one piece of candy another was delivered. For 15 minutes each child was allowed to eat as much candy and play with the PBM as much as she wished. (It took about the same amount of time to eat a piece of candy as to make a PBM response).

This first observation session was conducted to determine whether each child was a "manipulator" (that is, preferred playing the PBM to eating candy) or an "eater" (preferred eating to playing the PBM). Sixty-one percent of the children were "manipulators", or in other words, for 61 percent of the children, playing the PBM was a higher probability response than eating. Thirty-nine percent of the children were "eaters" for which eating was a higher probability response than playing the PBM.

In the second part of the experiment the children were divided into two groups. For one group manipulating the PBM was made contingent upon eating candy. For the other group eating was made contingent upon playing the PBM. According to Premack's hypothesis, it would be expected that for children who had a higher probability of eating than playing the PBM in the first part of the experiment (the "eaters"), making eating contingent upon playing the PBM should increase the number of PBM responses. Similarly, for the "manipulators" who preferred playing to eating, the number of eating responses should increase when playing the PBM is made contingent upon eating. Both of these predictions were confirmed.

For the eaters, the contingency "if play - then eat" raised the number of playing responses an average of 9.4 responses for a 15 minute session. For the "manipulators" the contingency "if eat - then play" raised the number of eating responses by an average of 25.5 responses per 15 minute sessions.

In the control condition, manipulators in the group with the contingency "if play - then eat" produced an average increase of only five responses per 15 minutes. The eaters in the group with the contingency "if eat - then play" produced an average increase in playing of only two responses per 15 minutes (Greeno, 1968).

This experiment successfully demonstrates that a high probability response can be a very effective reinforcer for a response of lower probability and that consummatory responses can be reinforced.

It also supports Premack's rejection of the traditional idea that eating is a trans-situational reinforcer, that is, it can serve as a reinforcer in all situations. Much experimental evidence shows that eating does not increase bar pressing in a satiated rat. According to Premack, this is because eating is not a high probability behavior in a satiated rat (Rachlin, 1976).

In adapting the animal manipulation paradigm to a laboratory study with children, Berger (1965) allowed 30 fourth grade students to choose between pressing two available micro switches. Pressing one switch provided the student eight seconds of the visual portion of a filmstrip while pressing the other switch allowed the student to listen to the audio portion for eight seconds. Each child's higher probability behavior was determined, either visual or audio choices, during a free response period.

Berger was then successful in increasing the frequency of low probability behaviors by using the child's higher probability behavior as a reward for pressing the lower probability switch. So, if a child preferred listening to the film, his number of pressings on the visual key increased when listening was made contingent on first making a visual response.

Another laboratory study conducted with college students as subjects tested the Premack hypothesis. McIntire (1963) employed a paired-associate learning task with 45 college students and was able to obtain faster learning of word lists by subjects receiving a more frequently occurring word as a reinforcer than by subjects receiving a low frequency word as a reinforcer.

Premack's Principle has been brought out of the laboratory to be tested in various applied settings. Hosie, Gentile, and Carroll (1974) employed the Premack Principle in the regular classroom setting to successfully show that a highly preferred activity can be used as a reinforcer for less preferred activities. Subjects in the experiment were 14 sixth graders randomly selected from a class of 28. After being instructed by the teacher that they could do whatever they wished for 20 minutes, the subjects were observed during two 20 minute sessions on different days. Each child was observed for the amount of time she spent modeling clay and painting. After the observation sessions, each child was categorized as preferring modeling clay if she spent more time during the sessions working with the clay, or as preferring painting if she spent more of the free time sessions painting.

On another day during free time, a third observation session was held to determine the amount of time the children spent reading. During this free time session, the painting and modeling clay kits were not in the room, however, a number of books on dinosaurs were. The teacher told the children that they were free to choose any activity normally available during free time, including reading the dinosaur books. If they chose to read these books they had to answer six questions on the dinosaur material.

As a result of the three observation periods, independent response rates for writing book reports on dinosaurs, painting, and modeling clay were obtained for each child. None of the children spent any time on writing the reports on dinosaurs.

During a 50 minute test session, half of the children who preferred painting were allowed to paint contingent upon the correct completion of the report on dinosaurs; the other children who preferred painting were allowed to model clay (a less preferred activity for them) after writing the report. Similarly, the students who preferred modeling clay were divided into two groups. One of the groups was allowed to model clay contingent upon the correct completion of the dinosaur report; while the other group was allowed to paint after completion of the report writing task.

Premack would predict that children promised their preferred activity should finish the report sooner than those promised a less-preferred activity. This is what happened. Students who were promised their highly preferred activity as a reward for finishing the report quickly finished it. The students who were promised their less preferred activity took much longer to complete the report.

Holt (1971) employed the Premack Principle in a more applied setting using two retarded children as subjects and the observed high probability behaviors of coloring or playing with dolls as reinforcers. He succeeded in reducing the time required to complete academic behaviors when the children had to finish a fixed unit of academic work before they could engage in five minutes of coloring or playing with dolls. This study demonstrates the power of the Premack Principle in helping to determine effective rewards for children, especially retarded students who may not be responsive to the more traditional rewards used with average students.

Wasik (1970) was able to increase the appropriate classroom behavior of 19 second grade culturally deprived children by making free time activities, (playing with toys, games and crafts) high probability behaviors, contingent upon "good" behavior. Appropriate behavior increased during the contingent condition and decreased when the free time activities were no longer contingent upon good behavior.

Roberts (1969) used the Premack Principle to change the phobic attitude toward confinement of a 40 year old male paranoid schizophrenic by making cigarette-puffs (an observed high probability behavior) contingent upon positive verbal statements by the subject with respect to confinement. The contingency significantly increased positive statements.

Mitchell and Staffelmayr (1973) significantly increased the amount of work activity (a low probability behavior) engaged in by two long-term schizophrenics by making the high probability behavior of sitting contingent upon doing one of the institution's common work tasks (coil stripping) for a certain length of time. This was a particularly effective use of the Premack Principle since these two men had a long history of not responding to such common reinforcers as candy, cigarettes, etc.

The Premack Principle is often cited in behavior modification textbooks (Bandura, 1969; Kanfer and Phillips, 1970; Liberman, 1972; Sulzer and Mayer, 1972). However, Ayllon and Azrin's book, **Token Economy** (1968), details the most complete behavior modification program using the Premack Principle. The authors interpret the principle by stating the "Probability of Behavior Rule: Observe what the individual does when the opportunity exists. Those activities that are very probable at a given time will serve as reinforcers." (1968, p. 60).

A typical Ayllon and Azrin study conducted in a mental hospital demonstrated that such high probability behaviors as attendance at religious services or attendance at a commissary could be used to reinforce lower probability behaviors which the patients had to engage in to earn a token to participate in the higher probability behaviors.

Applying the Premack Principle to Change Behavior

To review Premack's definition of a reinforcer: a behavior which has a high probability of occurring in a free operant situation will serve as a reinforcer for a behavior which has a lower probability of occurring if the high probability behavior is made contingent upon the performance of the low probability behavior (1959). In order to effectively employ the Premack Principle it is important to note the words "free operant situation," "probability" and "contingent" in the above definition.

By "free environmental situation," Premack means an environment in which a person is totally free to choose the available activites in which he wishes to engage. "Probability" refers to the relative frequency or amount of time spent responding. "Probability of responding" is used as an indication of preference or liking for an activity. "Contingent" refers to the fact that the only access to the high probability behavior is through performance of the low probability behavior. The importance of understanding these terms will become evident as this section continues.

The First Step

The first step in employing the Premack procedure is to determine the preference hierarchy or order in which the behaviors are likely to occur. The question becomes, what is the best way to ascertain a subject's preference for or probability of engaging in these responses?

Premack (1959) suggests that the hierarchy be determined by response rate, meaning the number of times the activity is performed or the total amount of time spent engaged in the activity. The idea is that the more an individual prefers an activity, the more often she is likely to perform it when she is free to choose. The more a person performs a particular activity the higher it would be ranked in that person's value hierarchy.

In an effort to clarify the procedure, the same example will be cited throughout this section. Let's say that a psychologist wants to increase the amount of time a child spends reading library books in the classroom during free time. He notices that the child spends most of her free time playing games or listening to records.

The first step in using the Premack procedure in this situation would be to determine the child's relative preference for the three activities: playing a game, reading a book or listening to records. The child could be observed in the same environment on three occasions during which she would be presented with the opportunity to perform one of the activities each time. The observer would record the response rate either by total time spent engaged in the activity or by how many times the child performed the activity in a given time period.

If the frequencies for the child came out in the rank order listing to records, greater than playing a game, greater than reading a book, from highest to lowest it would be expected that the opportunity to listen to records could be used to reinforce playing a game or reading a book. Playing a game could reinforce reading a book but not listening to records (Hillgard and Bower 1975).

Another way of determining a child's relative liking for responses is to place the child in a situation in which all the activities are simultaneously available for her to perform. Then, how frequently or how much time the child spent engaged in each activity would be recorded. Continuing with the preceding example, the child would be placed in a setting in which she was free to read, play a game or listen to records. Time spent in each activity would be recorded.

Wasik (1970) and Hillgard and Bower (1975) contend that with most children their preferential rankings of potential reinforcers can probably be validly obtained by simply asking them to verbally rate how much they like performing a certain activity. In other words, the student would simply be asked "what do you like to do best, play a game, listen to records or read books?"

Many psychologists have felt it sufficient to just ask a child to rank his response preferences, while others have used their own variations of Premack's prescription to determine response probability (such as just assuming by previous experience with children that playing is more reinforcing than reading or by informal observation of the child or asking the child's parents what he likes to do). It must be mentioned that if a psychologist uses any procedure other than that suggested by Premack, namely, independent response rate, to assess the relative preference rankings for activities, he is taking liberties with the principle that may result in an inaccurate value hierarchy.

In deciding which of the relatively valued activities to use as reinforcers, Premack maintains that his principle is most effective when the activities are farthest apart on the hierarchy (Rachlin, 1976). Therefore, in the preceding example in which the child's rank ordering of activities was listening to records, playing a game then reading a book, listening to records would be a more effective reinforcer for reading a book than playing a game since listening to records is farther away on the hierarchy.

The Second Step

After the relative values of the activities to be used in the hierarchy have been identified, the next step is to decide how much of the more highly valued activity should be given the child to reward him for performing the lesser valued activity. Homme (1970) suggests that children be allowed to participate in the reinforcing activity for three to 10 minutes. He believes that if any less than three minutes is allowed, the student will not have time to get involved in the activity. If more than 10 minutes is allowed, the student will grow tired of the activity and it will become ineffective as a reinforcer. According to Homme (1970) the decision on exactly how much reinforcement time the child should be given may be based on the difficulty of the task he has to perform to obtain the reward; the harder the task the more time he has with the reinforcing activity.

The Third Step

The third step in using Premack's analysis of reinforcement is the contingent phase; during which the opportunity to perform the highly preferred activity is made contingent upon the performance of the lower probability behavior. If listening to records is being used to reinforce reading a book, then the child's opportunity to listen to records for 10 minutes would be made dependent upon his first reading a book.

Studies (Houtz and Feldhusen, 1976; Wasik, 1970) have shown the importance of establishing a clear contingency relationship between the high and low probability behavior. That is, if the students do not perceive the high probability behavior as a reward contingent upon their performance of the low probability behavior, then the low probability behavior will not increase. Consequently, the psychologist must make it clear to the child that access to the reinforcing activity, listening to records, is dependent upon the child's reading a book. If listening to records sometime after reading a book is looked upon as normal routine, it is very likely that the response of reading a book will not increase. Another method to clarify the contingency relationship is to keep the amount of time as brief as possible between performance of the lower probability behavior and access to the rewarding activity.

The Final Step

The final step is an evaluation of whether the procedure is working. Is listening to records serving as an effective reinforcer for reading a book? The answer to this question is obtained by comparing the time spent reading in the contingent phase with the time spent reading during the observation period when the relative preferences were being determined. If the time spent reading has increased significantly above the baseline observation rate, then listening to records is functioning as a reinforcer for reading (Hillgard and Bower, 1975).

If the method is not successfully changing behavior, there are a few possibilities that the psychologist might investigate as causes for the failure (Hosie, Gentile, and Carroll, 1974). First, is the value hierarchy accurate? The preference rankings are much more likely to be correct if preference has been operationalized as rate of behavior measured during baseline observation periods. If another method of establishing probability has been used (such as paper and pencil inventories) the activities may not be correctly ranked.

Secondly, the availability of other reinforcers in the contingent phase may interfere with the student's choosing to perform the less preferred behavior. The psychologist should carefully set up the environment so that other available reinforcing activities are kept to a minimum during the contingent phase.

Finally, the less preferred activity may be too difficult for the child to perform or he may be asked to perform it for too long a period of time before obtaining access to the reinforcing activity. The less preferred task may have to be simplified or shortened in the beginning so that the child will be able to earn the reinforcing activity.

To review, the basic steps in applying the Premack Principle are:

1. Set up an observation session (or sessions) during which the child is free to engage in the activities you are interested in modifying.

2. Decide how much time the child should be allowed to engage in the more highly valued activity as a reward for performing the less preferred response.

3. Set up the contingent situation in which the child's access to the highly valued activity is clearly made contingent upon his performance of the less preferred activity.

4. Evaluate whether the procedure is successful by comparing the time spent engaged in the less preferred activity during the contingent phase with the time spent during the observation period. If a significant increase is noted it may be assumed that the high probability behavior is acting as a reinforcer for the less preferred activity.

Perhaps the most helpful way to illustrate how the Premack Principle can be applied to both regular and special education behavior problems is to look at some experiments which have systematically employed the Principle to modify behaviors.

Problem: A 13 year old sixth grade student in the regular classroom consistently performs poorly in math.

A 13 year old sixth grade student with low math achievement was the subject of an experiment designed by Andrews (1970-1971) to demonstrate the use of the Premack Principle to modify behavior in the regular classroom. The boy's behavior in math class was observed for one week. He was noted to be spending most of his time reading sports books instead of working on his math. During this observation week the boy completed approximately 20 percent of each math assignment.

Employing Premack's generalization, a contract was drawn up with the boy such that on any day he finished 50 percent of his math assignment correctly, he would be given 10 minutes of free time to read sports books. The student met the terms of the contract on the first day and each day following for a week. Then the criterion was raised to 60 percent and two more minutes of reading time was added to his reward. Again the student was successful in obtaining the reward every day of the week. The criterion was raised over the next three weeks until the student's final contract called for 15 minutes reading time contingent upon 80 percent completion of his math assignment. A follow-up one month later showed that the boy was still successfully meeting the criterion.

The above experiment demonstrates how a previously unwanted behavior, reading sports books, can be used to reinforce a more desired behavior. Andrews suggests that this is one of the "more powerful ramifications of the Premack hypothesis. Specifically, an experimenter may often use the behavior he is trying to minimize to reinforce a behavior he is attempting to maximize" (1970/71, p. 78). Andrews cites examples such as using talking with classmates, a high probability behavior, to reinforce not talking with classmates, a lower probability behavior for some students.

Problem: A class of culturally deprived low-performing seventh graders was exhibiting mild to severe behavior problems during English class.

Andrews (170/71) employed the Premack Principle with culturally deprived low achieving seventh graders who were hitting, being verbally aggressive and talking with peers during English class. During observation periods it was noted that these

behaviors occurred at a rate of 15 to 20 per hour. It was also observed that when students were given free time they spent much of the time working with student tutors or watching television. During the free time sessions the incidence of inappropriate behaviors was only five to ten per hour. Andrews set up a program that called for the high probability behaviors of watching television and working with peer tutors to be made contingent on the low probability behavior of engaging in appropriate behavior during English class.

A class meeting with the students, teacher and experimenter produced a list of 12 behaviors including the disruptive behaviors listed above. These behaviors were operationally defined and listed on the blackboard. The students then agreed to an arrangement which stated that if no more than three of the behaviors occurred during English class they would be allowed to meet with peer tutors or watch television in the afternoon. Students reached criterion on the first day and continued to do so successfully for four weeks.

By arranging the contingencies such that the high probability behaviors of watching television and interacting with peer tutors were dependent upon engaging in the low probability behavior of acting appropriately, Andrews was successful in greatly decreasing the incidence of inappropriate behavior. This experiment also demonstrates how the Premack Principle can be combined with other behavior modification techniques such as contingency contracting to make them both more effective.

Problem: Six girls at the New Mexico School for the Deaf (ages 11 to 13) were grouped in one class due to poor academic performance and less than average intelligence. Their teacher was experiencing difficulty maintaining the girls' attention. The major problem was the frequency of occurrence of behaviors incompatible with academic behavior; particularly the fact that the students were out of their seats when the teacher was trying to teach. This behavior disrupted the entire class and reseating the students meant interrupting instruction.

Osborne (1969) used the Premack hypothesis to increase the amount of time these six deaf girls spent at their desks in the classroom. During five days of observation periods the frequency of occurrence of the students leaving their seats was determined. Osborne observed that "the behavior of students leaving their seats was being maintained by the time away from school work it provided" (1969, P. 114). Accordingly, his behavioral program called for the high probability behavior of time free from school work to be made contingent upon the low probability behavior of staying seated.

Specifically, the girls were told that if they remained seated for 15 minutes they would be given "five minutes of your own time." At the end of the 15 minute period, those students who had not remained seated were required to stay in their seats working for the free time period. The others were free to leave their desks and engage in non-academic behavior during the five minute period.

Osborne's program significantly decreased out of seat behavior. Before the reinforcement contingency was introduced, the students were out of their seats slightly more than one time per 15 minute segment. During the free time contingent period, an out of seat response occurred approximately once every 30 minutes. Osborne points out that "in terms of financial outlay, the study provided a cost-free-technique for managing behavior available to most teachers." (1969, p. 118).

Problem: A teacher complained to the psychologist that her students were not completing their social studies assignments, while they were successfully finishing their science assignments.

Hartje (1973) had 108 fifth graders rate their liking for three subjects: reading, social studies and science. The students who were in the reinforcement condition in which they began with their low preference subject, progressed to their middle preference and finished with their highest preference subject significantly increased in their liking for their low preference subject over a pre-test measure on a one to 10 point scale. By using their highest preference subject as a reward for doing their least preferred subject the author increased the students' liking for the previously most disliked subject.

A teacher could easily use this "topic sequencing" procedure. For example, the teacher in the above problem could allow the students in her class the "privilege" of doing their science work only after their social studies assignments had been completed. This would use the high probability behavior of doing science to reinforce the low proability behavior or completing social studies assignments.

Advantages and Limitations of the Premack Hypothesis

Having described the Premack Principle and its application in some detail, it now seems appropriate to examine some of its advantages and limitations. The first positive aspect of the principle is that it takes the guesswork out of specifying reinforcers for a behavior change program by providing the psychologist with a simple and valid method of knowing in advance what activities will be reinforcing for a particular child. Before Premack's analysis of reinforcement, a behavior modifier counted on the trans-

situational nature of reinforcers in selecting rewards. Candy and stars were supposed to function as reinforcers for all children, but not all children responded to obtain these rewards.

Premack's method of determining rewards is "sensitive to the individual characteristics of a subject and also to his current state" (Hillgard and Bower, 1975). The reinforcers used can be tailor-made to fit a child's own needs and responses. This can be a unique advantage when dealing with a special education student, such as a retarded child, who may not respond to standard reinforcers.

Secondly, since the Premack Principle views reinforcers as preferred behaviors (such as drawing, reading, playing games, etc.) as opposed to the traditional conceptualization of reinforcers as stimuli or objects (food, water, stars, etc.), it provides the behavior modifier with an almost unlimited variety of naturally occurring classroom activities that can be used as reinforcers (Knapp, 1976). Among the advantages of using activities as reinforcers is the fact that many institutions would like to use behavior modification programs but cannot afford to provide material rewards. Studies with the Premack Principle have demonstrated that behavir modification techniques can be successfully carried out in the classroom with no financial cost by using preferred activities as rewards.

Furthermore, many people object to behavior change programs because of the material rewards involved ("Why should we pay students for behaving?"). People generally do not object to activities as rewards for changing or maintaining behaviors.

There are some unresolved problems with Premack's analysis of reinforcement. Hillgard and Bower (1975) and Rachlin (1976) question the validity of using response rate as an indicator of preference for all responses. Premack (in Hillgard & Bower, 1975) himself acknowledges that it is not always possible to obtain comparable measures of preference using response rates with widely varying activities.

The most used example of an activity whose preference or reward value cannot be validly determined by the amount of time devoted to it is sex. Animals usually engage in sexual activity for only a relatively small amount of their time. If response rate is used to indicate preference, then sex would occupy a low position on the value hierarchy of activities. This does not coincide with the facts. Rats will increase their lever pressing responses tremendously if they are rewarded with a sexual partner (Rachlin, 1976).

According to Premack's analysis, an activity of low value (which sex is, if response rate is used as an indicator of preference) should never function as a reward for an activity of higher value (lever pressing). But, lever pressing is not a low value activity for a rat and yet it can be reinforced by sex (Rachlin, 1976).

The answer to the above contradictions seems to lie in the length of the baseline period during which the responses are being rated for preference. That is, if a rat is observed for a short period of time; for example, five minutes, he is likely to spend much of this time engaged in sexual behavior and it would be concluded that sex is a highly valued activity. However, if the length of the base period were one hour, it is very likely that the rat would spend most of this time engaged in other activities and only a small amount of time engaged in sexual activity. Thus, the length of time of the base period being used to determine response probabilities can affect where they are placed in the individual's value hierarchy.

The same problem might arise when response probabilities are being rated for children. For example, if a psychologist was trying to rank reading or playing a pinball machine and she used a very short observation period; it is very likely that pinball machine responses would predominate over reading. However, if she made the baseline period longer, it is possible that the time spent reading would be greater than the time spent with the pinball machine.

While it appears that this criticism of the Premack analysis is legitimate for a few activities, for most practical purposes response rate is most certainly a valid indicator of preference.

A second difficulty likely to be encountered when applying the Premack Principle has to do with determining how much of the lesser valued activity should be required before the individual is allowed to engage in the more highly valued event; and then determining how long the individual should be allowed to engage in the more highly valued activity that is used as a reward (Rachlin, 1976).

There are no well-researched answers to these questions, only the general guidelines provided by Homme (1970) mentioned in the section dealing with applying the procedure. This criticism is not unique to the Premack procedure. Most behavior modification techniques do not specify how much of the reward should be given for it to be an effective reinforcer and to avoid satiation effects.

Summary

To summarize, according to Premack, whether or not an activity is a reinforcer depends on its relative probability of occurring compared to the response it is to reinforce. "Of any two responses, the more probable one will reinforce the less probable one" (1965, p. 132). Therefore, an event cannot be said to be a reward until its position in the person's value hierarchy is known.

This relativistic analysis of reinforcement differs considerably from the traditional absolute view which classifies an event as either being or not being a reward. Furthermore, Premack claims that the value hierarchy can be empirically determined by using rate of responding as an indicator of preference, providing psychologists with a very effective method of identifying which activities will serve as reinforcers for a person in a particular situation.

The chapter reviewed many experiments demonstrating how the Premack Principle can be employed in classroom situations. It is a very simple and non-obtrusive technique which seems to lend itself particularly well to educational settings. Since the principle fosters the use of naturally occurring activities as rewards, the experimenters were able to use materials and procedures common in most classrooms. In most of the applications, the only modification in classroom procedure was the baseline observation periods.

This chapter also attempted to show how the Premack procedure may be combined with other behavior modification techniques resulting in a more powerful behavior change program. The major contribution to any behavior change program provided by Premack is his operationally defined method of selecting reinforcers in advance.

In conclusion, it appears that the Premack Principle can be a very simple and effective method of changing behavior and is an excellent way of improving a behavior modification program by aiding in the selection of effective reinforcers.

References

Andrews, H. B. The systematic use of the Premack Principle in modifying classroom behavior. Child Study Journal, 1970/71, 1, No. 2, 74-79.

Ayllon, T. and Azrin, N. The Token Economy: A Motivational System for Therapy and Rehabilitation, New York: Appleton-Century-Crafts, 1968.

Bandura, A. Principles of Behavior Modification. New York: Holt, Rinehart and Winston, Inc., 1968.

Berger, R. J. A test of the Premack hypothesis with responses to audio and visual stimuli. Doctoral Dissertation. Arizona State University, Ann Arbor: Xerox University Microfilms, No. 65 - 10, 371 1965.

Danaher, B. G. Theoretical foundations and clinical applications of the Premack Principle: Review and critique. Behavior Therapy, 5, 1974, 307-324.

Greeno, J. G. Elementary Theoretical Psychology. Reading, Mass.: Addison-Wesley, 1968.

Hartje, J. C. Premackian reinforcement of classroom behavior through topic sequencing. Journal of Psychology, 1973, 84, 61-74.

Hilgard, E. R. and Bower, G. H. Theories of Learning. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1975.

Holt, G. L. Systematic probability reversal and control of behavior through reinforcement menus. Psychological Record, 1971, 21 465-469.

Homme, G. L. How to Use Contingency Contracting in the Classroom. Champaign, Ill: Research Press, 1970.

Hosie, T., Gentile, J., and Carroll, J. Pupil preferences and the Premack Principle. American Educational Research Journal, 1974, 11, No. 3, 241-247.

Houtz, J. and Feldhusen, J. The modification of fourth graders' problem solving abilities. The Journal of Psychology, 1976, 93 229-237.

Hundt, A. G. and premack, D. Running as both a positive and negative reinforcer. Science, 1963, 142, 1087-1088.

Kanfer, F. H. and Phillips, J. S. Learning Foundations of Behavior Therapy. N.Y.: Wiley, 1970.

Knapp, T. The Premack Principle in human experimental and applied settings. Behavior Research and Therapy, 1976, 14, 133-147.

Liberman, R. A Guide to Behavioral Analysis and Therapy. New York: Pergamon Press, 1972.

McIntyre, R. W. Reinforcement and verbal learning: A test of the Premack hypothesis. Psychological Reports, 1963, 12, 99-102.

Meehl, P. E. On the circularity of the law of effect. Psychological Bulletin, 1950, 47. 52-75.

Mitchell, W. S. and Staffelmayr, B. E. Application of the Premack Principle to the behavioral control of extremely inactive schizophrenics. Journal of Applied Behavioral Analysis, 1973, 6 419-423.

Osborne, J. Free time as a reinforcer in the management of classroom behavior. Journal of Applied Behavior Analysis, 1969, 2. No. 2, 113-118.

Premack, D. Catching up with common sense or two sides of a generalization: Reinforcement and punishment. In R. Glaser (ed.) The Nature of Reinforcement. Academic Press N.Y., 1971. 121-150.

Premack, D. Rate differential reinforcement in monkey manipulation. Journal of the Experimental Analysis of Behavior, 1963, 6, 81-89.

Premack, D. Reinforcement theory. In D. Levine (ed.) Nebraska Symposium on Motivation. Lincoln: University of Nebraska Press, 1965, 123-180.

Premack, D. Reversibility of the reinforcement relation. Science, 1962, 136, 255-257.

Premack, D. Toward empirical behavior laws. I. Positive reinforcement. Psychological Review, 1959, 66, No. 4, 219-233.

Premack, D., and Premack, A. J. Increased eating in rate deprived of running. Journal of the Experimental Analysis of Behavior, 1963, 6, 209-212.

Premack, D., Schaeffer, R. W. and Hundt, A. G. Reinforcement of drinking by running: Effect of fixed ratio and reinforcement time. Journal of the Experimental Analysis of Behavior, 1964, 7, 91-96.

Rachlin, H. Behavior and Learning. San Francisco: W. H. Freeman and Co., 1976.

Roberts, A. E. Development of self-control using Premack's differential rate hypothesis: A case study. Behavior Research and Therapy, 1969, 7, 341-344.

Rumin, D. C. and Masters, J. C. Behavior Therapy. New York: Academic Press, 1979.

Sulzer, B. and Mayer, G. Behavior Modification Procedures for School Personnel. Hinsdale, Ill.: Dryden Press, 1972.

Wasik, B. H. The application of Premack's generalization on reinforcement to the management of classroom behavior. Journal of Experimental Child Psychology, 1970, 10, 33-43.

Yawkey, T. D. and Griffith, D. The effects of the Premack Principle on affective behaviors of young children. Child Study Journal, 1974, 4, No. 2, 59-70.

Differential Reinforcement of Low Rates:

the Problem of Applying Theory to the Classroom Situation

by
Philip B. Bowser
Roseburg Public Schools
Douglas County #4
Oregon

Introduction

Differential reinforcement of low rates (DRL) is a term applied to a system of contingencies which contact a target behavior. As a theoretical construct, DRL has enjoyed much exposure in the literature (Kramer & Rilling, 1970), but until recently, practitioners have had difficulty applying the construct outside of the laboratory. Deitz and his colleagues, as recently as 1978, found only one study which directly attempted to apply a DRL schedule in a practical way. What features of the DRL schedule could possibly account for the 20 year lag between development and application?

This paper will attempt to deal with this question in the following manner. First, the construct will be described, followed by a selective review of the animal research. This should provide a theoretical background for a discussion of those few studies which attempted to use the DRL schedule with humans in the natural environment. Finally, the advantages and disadvantages of the DRL schedule will be weighed to help school psychologists incorporate the procedure into the treatment plan for a referred child.

As one might expect, the discussion begins with Ferster and Skinner (1957): "A schedule of reinforcement may be defined without reference to its effect upon behavior. Thus, a response may be reinforced on the basis of the time which has elapsed since the preceding reinforcement or on the basis of the number of responses which have been emitted since the preceding reinforcement." (p. 2)

In the case of DRL, we have two components to consider. The first component deals with differential reinforcement, and the second concerns the target behavior which is differentially reinforced. Differential reinforcement is a condition in the environment which is contingent upon a particular quality of a stimulus, a particular quality of a response, or a given rate of responding.

For example, if we decide to differentially reinforce a child with candy, the candy could be applied only when a signal lamp in the room is green. The child could then learn to engage in the target behavior only when the light signals the high probability of reinforcement. Or, we could require the target behavior to reach some criteria in terms of intensity or duration which would separate the reinforced responses from ones which are similar, but not quite hard enough or long enough. Finally, we could require a predetermined rate of response. In all cases, a discrimination is developed which separates similar stimuli or similar responses.

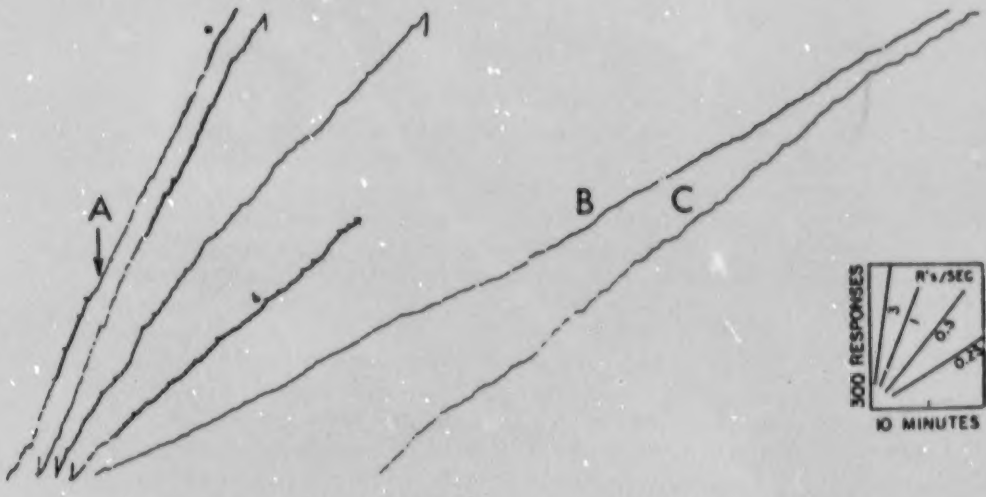
The discrimination of interest in the DRL schedule is the rate at which the subject is responding. We are all aware that reinforcing a given behavior will increase the probability that the response will occur again. In DRL, we are reinforcing behavior which occurs less frequently than before. In a sense, we are attempting to increase the production of less behavior.

Ferster and Skinner's (1957) work with pigeons was based on measuring the amount of time which occurred between responses. A timer was connected to the target disk which the pigeons pecked for food pellets. A certain minimum time was selected; if the pecks occurred after the given setting, the pellet was dispensed. If the peck came before the time was up, the timer was reset. The amount of time between pecks became known as the inter-response time (IRT), and it was this system of arranging the DRL contingency that dominated the animal research for many years. The authors noted that DRL could occur when the rate of behavior was below some specified value, suggesting that measuring IRTs was not the only possible system. However, few people attempted to discover another measurement system. (Ferster & Skinner, 1957, p. 726)

Figure 1

Transition from VI-1 to VI-1, DRL-6

(Ferster & Skinner, 1957)



The data presented in Figure 1 are taken from Ferster and Skinner (1957). The letter A marks the end of several sessions in

which the animal showed a stable performance on a variable interval, one-second (VI-1) schedule. On this schedule, the animal received a food pellet every time an average of one second elapsed between pecks. At A the rate was about 1.1 responses per second. Beginning at A, DRL-6 was imposed. Now each peck had to occur at least six seconds after the last one, or the reinforcement timer was reset to count off another six seconds. For the animal to receive every possible pellet that could be made available, the rate would have to be exactly once every six seconds. At B the rate had reduced to 13 responses per minute. The record shows that extra responses tended to occur in clusters following a reinforcement. Track C shows this "bursting" effect more clearly with another bird.

In some ways, the performance of animals on a DRL schedule resembled animals on extinction. The behavior consistently declined in rate, with occasional attempts to see if the old schedule happened to be reinstated. One advantage of the DRL schedule was that the rate tended to stabilize near the DRL criterion rather than stop totally. This stabilization gave experimenters a fascinating schedule to work with. Here was a way to reduce behavior by positive means (as opposed to extinction or punishment), and then hold the behavior steady at the reduced rate. The schedule suggested that Ss responding efficiently must have some time-sensing system, particularly as the DRL criterion became larger and larger. Finally, the DRL performance itself could become a dependent variable, as factors which altered the steady low rate of responding were manipulated experimentally. Here was a new toy for the university labs.

Review of the Literature

The review which follows is selective, and draws heavily upon the excellent review by Kramer and Rilling (1970). For those interested in more detail, this source comes highly recommended. A summary of the applied research will follow, bringing the reader up to date on the basics. Understanding these basics will assist the school psychologist in applying a DRL schedule in a school setting.

Three DRL Studies

Beginning their report with an account of the number of DRL studies available at the time of their writing, Kramer and Rilling (1970) suggested two main reasons why the DRL work occupied so many pages in the journals. First, there seemed to be a large interest in documenting the characteristics of the schedule. As time passed and the characteristics became known, the performance of an S while functioning under a DRL schedule became useful as a dependent variable. Various treatments could be applied to see what effect the change would have upon stable DRL performance.

There were basically three systems found in the animal studies for setting up the DRL schedule. Providing reinforcement for a specific IRT was one of the earliest, building on the previously mentioned work of Ferster and Skinner (1957). It quickly became apparent that the time spent in consuming the reinforcement was a critical factor. When the animal was occupied at the food tray, it allowed the passage of time and therefore increased the probability that the next response would occur after the minimum IRT. Eventually, holding the clock so that time spent consuming reinforcement did not become part of the data became the standard procedure.

Another system became known as DRL with limited hold (DRL-LH). Again, a minimum waiting time was required between responses, but in limited hold the reinforcement would not be unconditionally available. A predetermined time was established in which the S could obtain the reinforcement. For example, in a DRL-6 LH-2 schedule, any pair of responses which occurred with less than six seconds of seperation were not reinforced. If the second response occurred after six seconds but before eight seconds, the reinforcement would be set up. Second responses which occurred eight seconds or more after the first movement were not reinforced, but the action did reset the timer.

One option which was always available but rarely used before the 1970s was the application of reinforcement for n or fewer responses within a certain time interval. For example, if one wanted an average rate of ten responses per minute, one movement or less within any block of six seconds would set up reinforcement. Of the three options mentioned so far, the third is the only choice which is precisely explained by the title, DRL. In the third option, an actual rate is observed and reinforced; in the other options, a class of IRTs is reinforced, not actually a rate. The continued production of a given IRT will determine a rate eventually, but at the moment of reinforcement, rate is not a factor of concern.

The reader may question the necessity of such a "picky" level of precision in a paper of this type. As one reads the history of the DRL technique, it becomes clear that failure to perceive the fine differences has led to failures in replication and flat misinterpretation of the data.

Since the point of this review is to orient the practitioner to the literature so that application of the technique can occur, understanding the "picky" aspects quickly becomes important. As Wood (1978) has been known to observe on more than one occasion, it is this type of fine discrimination that separates someone who knows a little bit about passing M&Ms around the classroom and someone who scientifically applies the techniques of behavior analysis. As an incentive to read ostensibly dull material, comments and asides have been strategically placed to suggest areas of application or research. The individual who skims will probably miss these islands of more interesting material.

Recommendations for those who wish to pursue DRL research are included in the Kramer and Rilling (1970) paper. The authors specified four types of data anlaysis which, if included in the manuscript, would produce a study which has a reasonable chance of being replicated fairly. Since these suggestions were not generally available until 1970, the DRL research is filled with inconsistencies and confusion as to the generally-accepted explanations for the phenomina observed. Within the general categories which follow, Kramer and Rilling (1970) found the field of psychology to be speaking with many voices, thus making the school psychologist's search for clear suggestions more difficult.

Bursts

Animals who had been exposed to schedules which encouraged a high rate of responding typically followed a reinforcer on a DRL schedule with a quick series of responses, called "bursting." Bursting naturally reduced the efficiency ratio, and was an interesting enough characteristic of DRL responding to become a topic in itself.

The issue is not entirely settled. One problem involved species differences. Rats, for example, tended to burst more than pigeons, even though rats typically were believed to be able to make better time discriminations than pigeons. Could bursting be dependent on reinforcement history for some species but not for others? Another explanation involved the amount of feedback which the Ss received about what is a criterion response and what is not. The same motion provided reinforcement or non-reinforcement. When the aspect of time could not be explained, there was a large opportunity for ambiguity over criterion to exist. Bursting may be, in part, a superstitious behavior which is accidently reinforced.

What could the school psychologist expect from students placed on a DRL schedule? Are humans the type of species that would engage in bursting? Depending on the nature of the target behavior, bursting may be an unacceptable problem in the classroom. Would explaining the system to the human S eliminate the problem of bursting? The school psychologist with a bent for research could be kept busy in this area for some time.

Sequential Dependency

One of the few areas where a consensus seems to exist is in the area of sequential dependency. The records of DRL Ss tended to show periods where several reinforcements were earned one right after another. Then, after premature responses broke the pattern of success, a long string of failures to earn reinforcement occurred. This tendency towards a clumping of successes and failures, known as "sequential dependency," was clearly shown in a study by Farmer and Schoenfeld (1964). Rats on a DRL-10 schedule earned 60-70% of their reinforcements within 10-15 seconds of each other.

The observation of the phenomenon is more frequent than a theory to explain it. Farmer and Schoenfeld (1964) believed that the timing behavior of rats may be more accurate following reinforcement than following failure to reinforce. Feedback may help to explain this--a reinforced response has at least some clue as to what was expected. The unreinforced response starts the S back at "GO" without the $200.

As with the discussion of bursting, it is uncertain at this point whether the practitioner should expect a sequential dependency to show in the classroom. It would appear that the timing situation would have to be fairly rigorous, and again, the human's ability to understand instructions regarding the intervention may eliminate the problem altogether. One could be aware of the problem when working with severely handicapped individuals who may show a limited ability to understand instructions, and begin with a DRL schedule on which it would be difficult to avoid reinforcement. In this way, one would maximize the probability of a string of successes.

Extinction and Reconditioning

When all reinforcement is withheld, the Ss in a DRL study are placed on extinction. How long it will take before the S gives up cannot be predicted. Within species there exists great variability; some Ss give up quickly, others continue responding longer than the researchers are willing to observe.

One theory to explain variable extinction comes from the body of research which looked to see how quickly an S re-learned an extinguished response. As with other reconditioning studies Ss generally acquied the DRL performance much more quickly than it was established in the first place. It could be that the reinforcement gradually became a discriminative stimulus for further spaced responding.

Because withholding, then responding obtained reinforcement, the presence of the reinforcement signalled that more reinforcement was available. The animal could then begin a chain of time-consuming behaviors--perhaps the same chain that won the last reinforcement--and possibly succeed again. Conversely, omission of a reinforcement for a behavior may signal that the conditions have somehow changed. The S could begin to engage in various attempts to recreate the reinforcement condition, perhaps through bursting or some other superstitious system.

The role of reinforcement feedback could be used effectively in the classroom setting. Every time a child on a DRL schedule earns a reinforcement, the presence of that reinforcement in effect places a seal of approval on the behavior which has occurred in the recent past. Not only is the child failing to engage in "garbage behavior", but the child is given a crystal-clear hint as to what is acceptable.

Mediating Behavior

The previously-mentioned chain of time-consuming behaviors has become known in the literature as mediating behavior. Since mediating behavior is not a consistent feature of a DRL study--at least not an always observable feature--there is some argument as to what constitutes mediation and what accounts for its presence.

For example, if some activity is regularly produced while the DRL clock is running, the S is probably removed from the lever and has less of an opportunity to respond before the time limit is up. Conceivably, responding could be more efficient than if the mediating behavior did not develop. One could expect mediation to be a desirable characteristic.

Part of the argument stems from the fact that similar animals may or may not engage in mediating behavior, and if they do, it is occasionally at the "suggestion" of the experimenter. For example, Cohn (1979) added a drinking bottle and McGown, Spencer, and Neetz (1977) provided sticks of wood for the animals to chew. These objects could lure the animal away from the target without any real effort on the part of the S to "use up" time. The distinction was eventually made that if a string of time-consuming behaviors could be chained together, so that one part of the chain became a discriminative stimulus to kick off the next behavior in the chain, that the behavior would be assumed to be a time-mediating system. If the behavior just happened to occur without any indicating that any function could be attributed to the behavior, then it would be known as collateral behavior. Again, the field is ripe for the work of a researcher with a keen insight to the situation.

Some of the confusion in this area is typified by the Barry (1971), McGown et. al (1977), and Cohn (1979) studies. All examined collateral behavior, but comparisons between the studies are difficult because the authors observed different types of collateral behavior, used different DRL schedules, and used two different types of laboratory animals. One author cast doubt on the time-mediation function of collateral activities; another author claimed that we could not write the behavior off as an accident. The third suggested well-developed collateral behavior was helpful to DRL efficiency.

This body of research suggests solid footing only occasionally. If non-human Ss can be more efficient (sometimes) on a DRL schedule when a mediating system is available, then the hint for the practitioner is to directly instruct the referred child in appropriate mediating responses. At this point, it may sound as though we have slipped under the fence to a discussion of differential reinforcement of other behavior (DRO). However, a close examination will reveal we are still on our own side.

For reasons which will become clear later in this paper, a DRL system can incorporate some of the aspects of DRO, particularly with regard to mediating behavior and the special case of the DRL-0 schedule. However, the message at this point seems obvious--give the child an alternative behavior to use while lower and lower rates of misbehavior are encouraged through the application of the DRL schedule.

Cross-Species Comparisons

In the field of comparative psychology we find individuals who look at similar behaviors as they are acquired and used by varying species. The major comparative thrust has been with regard to the efficiency of responding on DRL schedules and the presumption of the ability of the organism to somehow measure the passage of time.

One might expect humans to do well, and the literature bears this out. Most of the standard laboratory animals can be trained to do relatively well on a DRL-regulated task, but some differences across species have been observed. Kramer and Rilling (1970) suggested that biologists may be interested in the differences in the timing behavior of animals. For example, pigeons' use of time may be part of the ability of the birds to orient themselves and determine distances when homing. Apparently, short time spans were easier for pigeons to handle, as variability increased when the schedule began to exceed DRL-20.

The aspect of internal timing mechanisms brings to mind the possibility of comparing children who have been identified as hyperactive with children who seem to have no attentional deficit. Clearly the need to establish the ability of a referred child to deal with the time constraints of a DRL intervention system should be a practitioner's priority. A baseline observation should be conducted which is sufficiently long to enable one to set a reasonable DRL schedule with a high probability of early reinforcement.

Punishment with DRL

We know that the DRL schedule produces less target behavior by reinforcing the increasing passage of time between responses. Although this is a positive approach to the reduction of behavior, we also know that punishment of a response will reduce the frequency of the target behavior. What would be the effect of punishing all responses which did not receive reinforcement?

Holz and Azrin (1963) approached this issue using pigeons and various levels of electric shock. A DRL-30 schedule was established, then the shock contingently applied. Generally, the worst approximations to the DRL-30 schedule were eliminated first (those with IRTs of five seconds or less). With increasing intensities of shock, non-reinforced responding gradually decreased, with the

frequency of long IRTs rising. Holz, Azrin, and Ulrich (1963) completed a follow-up study in which it was discovered that a sufficiently strong punishment could eliminate all responding. However, when the punishment contingency was removed, the behavior returned.

This study points out the problem of punishment--if the S is not likely to get "caught", the behavior will continue. Yet the conventional wisdom in many schools supports the use of punishment for low-level problems, and tends to avoid the appropriate use of punishment for severe problem behaviors on the theory that the disturbed child will become damaged by the punishment. The results of these punishment studies support the philosophy of positive behavior management, and suggest another alternative as yet untried.

Teachers have available several mild punishment contingencies. Writing sentences, time out, a stern look, and withholding privileges are usually easy to do. A student placed on a DRL system could conceivably incur a negative consequence for unreinforced target behavior, instead of ignoring. The punishment would have to be of a short enough duration so as not to interfere with the DRL timing. This also helps to reduce self or peer reinforcement which could occur in the absence of a teacher reaction. An angry scowl, announcing a "warning", or a short time-out in place by a the familiar head-on-desk could possibly assist the DRL system at those times when the reinforcement was lost to a high rate of responding.

Reinforcement Magnitude

The DRL deprivation studies showed essentially no differences in responding unless extreme levels of deprivation were initiated. However, the magnitude of the reinforcement seemed to play a large part in DRL behavior. For example, Beer and Trumble (1965) provided reinforcement in sizes ranging from one to four pellets. The larger reinforcement led to a faster rate of responding, with a loss of overall efficiency. However, the larger reinforcements provided more stable performance than the smaller reinforcements.

Hence, the practitioner should probably be cautious about the size of the reinforcement, and how the student is informed of progress throughout the session. Particularly if a large prize were lost at the end of the long session, the reaction of an uninformed S may be more negative than staff would be willing to accept. Traditionally, the reward menu has been used in the schools to prevent reinforcers from losing power. Possibly the menu could be adapted to the DRL system. If the class is already involved in a token economy, the transition should not prove to be difficult.

Post 1970 Basic Research

Basic research which was published following the Kramer and Rilling (1970) review gradually turned to using DRL performance as a dependent variable. Particularly the work stemming from the physiological psychologists is difficult for the outsider to understand and even more difficult to apply to the classroom. These studies will be touched upon briefly through the discussion of a few examples, then the chapter will take a turn towards the application of the DRL schedule with human subjects.

Ransford (1974) attempted to discover why the DRL schedule was difficult for pigeons, when the animals performed well on other timing tasks. The results were significant from the standpoint that he found small variations in the nature of the task could have a large effect on DRL efficiency. Simple displacement of the lever could lead to improved DRL performance. Hence, it became increasingly important for researchers to use lengthy observations before calling the animal's performance "stable." Premature assumption of stability would probably lead to unpredictable results, and most likely a failure to replicate.

Another issue of DRL performance was approached by Kramer (1971). At that time a theory existed which explained DRL performance in terms of an environmental stimuli taking on associations with low-rate behavior, and exerting stimulus control. If observed over a short time, data could support this theory. However, Kramer (1971) noted that given enough time, DRL performance would improve for all groups both with and without visual feedback which could be used as a discriminative stimulus. Fine discriminations of environmental stimuli were not necessary to explain DRL functioning, the sufficient explanation remained elusive.

Physiological studies generally created lesions in specific portions of a rat's brain with electrical current. The chemical imbalance thus created was enhanced or corrected by direct application of chemicals known to be associated with the area destroyed. The behavior of rats with lesions of the septum generally occurs at a higher rate. For example, Ellen, Makohon, and Richardson (1978) observed that septal rats functioned at much higher rates than normals on a DRL schedule, hence receiving few reinforcers. (The description of brain-damaged rats may sound familiar to those who use a brain damage model to explain human hyperactivity.)

Continuing the lesion studies, Aitken (1975) investigated the effects of visual and kinesthetic cues with both normal and septal rats. If the septals had an attention deficit, then their ability to handle cues should be impaired. The author's conclusion supported the theory that the effects of cues and feedback was more closely related to the type of feedback than to the presence or absence of lesions. Both types of animals did better with cues which occurred before the animal was committed to a response.

Although this study seemed to cast doubt on the brain-damage theory, the answer is far from certain at this point.

Thatcher's (1976) well-designed study used a combination of enzymes and cholinergic blockers to more finely determine the effects of septal damage. If the septum itself was not critical for the performance of learned responses, then the study supported the notion that the important pathways must go through the septum. Yet Ellen, Makohon and Richardson (1978) countered that such results could be explained by differences in reinforcement density. Through the use of a yoked reinforcement schedule which equated the reinforcement densities for normal and septal rats, their theory was supported. Septal damage may not cause rats to fail on a DRL schedule because of "hyperactivity". The septal damage may make organisms more sensitive to reinforcement distribution, and thus prevent septals from learning the DRL task accurately.

The results and contradictions are intriguing. Although the effects of septal damage are not clear, there seems to be a tendency for septals to respond to time and reinforcement density in a manner which is qualitatively different from normals. Assuming that people are willing to look from one species to the next with regard to the brain damage theory for attentional disorders, several areas for exploration become open to the practitioner.

When dealing with a referred child who has confirmed or suspected brain damage, it may be profitable to manipulate reinforcement density, or the Ss information regarding the passage of time and her/his performance. Changes in the duration or intensity of social feedback may need to be made to make sure that the stimulus has been received in the manner in which it was intended. Teachers may find schedule changes, questioning techniques, and all forms of signals to their dysfunctional students to be very important in maintaining a reasonable level of appropriate behavior. The possibilities for research are endless and potentially profitable.

Application of the Method

Studies of Reinforcement History

One aspect of human subject research involved reinforcement history. On the surface, it would appear that prior contact with a schedule that produced a high rate of responding would inhibit one's ability to shift to a DRL schedule. Weisberg (1970) looked at this issue using a group of 50 normal children aged 23-45 months.

Four groups were created at random from the initial sample. Group I received pre-training on the mechanism with a DRL-2 schedule. Group II was set to respond on a VR-10 schedule. Group III was trained using DRL-10. Group IV was given reinforcement on a FI-18 schedule. Following 50 trials on the initial schedule, six sessions on DRL-18 were observed.

Weisberg pointed to previous animal work which suggested that the most effective starting point for DRL training was at a rate which was about 50% of the target rate. Hence, Weisberg expected the DRL-10 group to have been primed for the DRL-18 work by practice on a schedule which was rughly half that of the final criterion. The hypothesis was supported.

The DRL-10 group learned the DRL-18 task more rapidly than any other group. The VR-10 group, trained to respond at a relatively high rate of speed, learned the DRL-18 task the slowest of the four groups. The FI-18 group, although experiencing a similar time frame, tended to show bursting which placed them third in the overall standings. Although all groups improved with additional time on the DRL-18 schedule, by the end of the sixth DRL session, the VR-10 group was still the most rapid responding of the four groups.

Weisberg concluded "The young naive child can learn to withhold behavior if known interfering repertoires are kept to a minimum." (p. 360) Apparently, we are led to believe that a normal child roughly between the ages of two and four can be trained to produce a certain minimal response only three times per minute on the average. Since the study dealt with lever-pushing instead of adaptive social behavior, shifting this information to the classroom is difficult.

If one looks at the reinforcement available to the misbehaving preschool child, one could conceivably find a high rate of behavior which is maintained by a variable schedule. To change this behavior using a DRL system, a reasonable IRT would need to be established. In the absence of any other decision system, the 50% rule used in Weisberg's paper may be a good place to start. However, this is just a rough starting point, and personal experience may suggest a different place to begin.

Another aspect of reinforcement history was approached by Leibowitz (1974). Again, students of average intelligence were trained to a lever-press in a special lab. The nature of the training provided each of two groups with either a variable ratio or a variable interval reinforcement history. The question in this study. concerned the relative effectiveness of DRO and DRL in reducing the rate of responses produced by the VR and VI schedules.

The results suggested that both techniques were effective in reducing the rate of responding. However, it appeared that the rate of reinforcement was a better predictor of rate during extinction than reinforcement history. Essentially, the more efficient responders continued to be the more efficient responders when the treatment was changed. Again, we have a situation where an uncontrolled variable, namely reinforcement density, arises to confuse an otherwise promising picture.

It may be helpful to realize that at least in one study, both DRL and DRO were effective in controlling the same behavior. This gives the practitioner a choice. The exact value of the study is difficult to determine since the lever-push was again used, and it is doubtful that a more complex string of behaviors would be so neatly reduced.

Shmueli (1974) evaluated both reinforcement history and the opportunity for collateral behavior in a doctoral dissertation. Human subjects were trained to a FR-5 schedule. Four telegraph keys were available, but only one was keyed for reinforcement. The other three enabled the Ss to experiment with lever-pressing as a form of collateral behavior.

When the schedule was changed to DRL-6 for half of the group and DRL-2.25 for the other half, collateral behavior on the other three keys was observed. One of the three keys was then removed to see how the collateral behavior would be effected. All Ss experienced some disruption of response efficiency due to the removal of the key; those in the longer DRL treatment group were disrupted the most.

These three glances into the arena of reinforcement history show some of the problems in comparing and generalizing the results. Apparently, reinforcement history has some effect on the ability of the S to learn DRL, although it may be the density of the reinforcement that is more important than the prior experience with any specific schedule. Additionally, the value of collateral behavior may be related to the amount of time which needs filling, although the data so far tend to emphasize responses which occur in intervals smaller than ten seconds. Also, the collateral behavior of concern has typically been observable.

Collateral Behavior Studies

In a study by Stein (1977), covert collateral behavior was discovered as an artifact of the training situation. The author had access to 20 female students of introductory psychology at a college. They were presented with four telegraph keys, each of which was connected to a visual cue (colored lights). An amber light signalled that the reinforcer--points applied to the final grade--had been awarded. A red light indicated the response had been in error, and this was punished by subtracting one point. The total point score was always visible on a counter placed above the keys.

For both groups, key #3 was set up for reinforcement; the other three keys provided the opportunity for collateral behaving. Half of the group was trained to FR-20 while the other half practiced FI-10. Finally, all tried the DRL schedule.

Stein's review of the literature led to the belief that practice with a slow FI schedule would aid the DRL learning. At the beginning of the DRL sessions, there were observable differences. However, both groups quickly became equivalent DRL responders. The effect of the schedule seemed to be related more to the type of collateral behavior than to efficiency. Those shifting to DRL from FI showed an absence of key-pressing collateral behavior. But during the follow-up interview, the FI group reported covert collateral behavior, such as counting.

Human collateral behavior has been an interesting area to examine. Recently, Kapostins (1961), Bostwick (1977), and Stein and Landis (1978) approached this issue from three different directions. Kapostins and Bostwick used a sample of college students, but Stein and Landis worked with children five and seven years of age.

All of the studies observed extensive systems to pass the time between reinforcements. The younger children in the Stein and Landis (1978) study tended to move instead of talk or count, suggesting that before the age of five, covert speech was of little help in withholding a response. Bostwick's subjects were provided additional keys upon which to tap, however in this study, those who were tapered into the DRL schedule gradually tended to engage in more looking around the room, etc., than those who began and stayed with the final DRL schedule. Kapostins' Ss were reinforced for low rates of saying pre-selected words, which had the side effect of producing odd sequences of words that the Ss believed were required for reinforcement. Ss also attempted to influence reinforcement by changing the tone of voice or by sensing a non-specific tension build-up.

Besides documenting the possibility of using DRL with different age levels and with different target behaviors, these studies presented the intriguing aspect of timing the humans. We seem to know relatively little about how public school children react to and monitor the passage of time. Particularly when one is working with problem children, this dimension may be one worth exploring.

Practical Applications

The chronology now brings us to the point where researchers begin to apply their understandings of the DRL schedule outside of the laboratory. One non-public school study was located (Davidson & Bremser, 1977). Since the study dealt with only two Veterans' Administration patients, it could hardly be considered representative of a larger population. However, the problem in question, alcoholism, was one which lent itself to the approach of reinforcing low rates. If the techniques proved to be successful, the Ss could engage in social drinking rather than total abstinance.

Alcoholics and DRL

In a sound-proof chamber, the patients pressed a plunger, similar to other DRL experiments. The reinforcer in this case was bourbon and water. The baseline observation was conducted under FR-30 conditions. After one thirty minute session on this schedule, DRL-30 began. As soon as the patients stabilized at one rate, the DRL limit was doubled. By the end of the study, one S was performing at DRL-16 minutes and the other at DRL-8 minutes. A return to baseline conditions completed the series of trials.

Follow-up showed that one of the Ss maintained controlled drinking at home whereas the other S returned to problem drinking shortly after discharge. Although both Ss learned low-rate drinking through the DRL training, only one individual seemed to generalize that experience. It seemed that the performance on the last baseline session was the best predictor of discharge behavior--the patient who drank successfully at home earned no reinforcers during the final baseline.

College Students' Behavior Maintenance

The Lipinski (1974) study shed some light on the maintenance of low rate behavior. In this doctoral dissertation, 20 college students in classes were reinforced for one of two behaviors. A reinforcer was earned for increasing the reliability of self-recorded data or reinforcement was earned by decreasing the behavior that was to be recorded. Here was a loosely-structured DRL situation.

Seven treatment conditions were observed, including situations where the students were monitored to check the accuracy of their self-recording. Occasionally the students were aware that they were being monitored. Lipinski discovered that if the Ss were reinforced for accurate recording, the rate of their behavior did not change. However, if the reinforcement was paired with lower rates, the behavior reduced in frequency but the accuracy of the self-recording did not change. Treatment effects were judged to be temporary, based on the presence or absence of a discriminative stimulus which cued the probability of monitoring.

These last two articles serve to underline an understanding which the practitioner probably knows well--undesirable behavior is always available to the S. Elimination of garbage behavior is more precisely the substitution of another behavior which hopefully will be more adaptive for the organism. So even if a classroom DRL program is successful in reducing behavior, a carefully-planned maintenance system will have to be initiated, or the DRL system will probably have to be left in place indefinitely. Otherwise, we could expect the behavior to gradually return.

Classroom Rules Violations

Most classroom misbehavior involves rules violations. But as Skinner (1969) asks, "A rule is imply an object in the environment. Why should it be important?" (p. 148) Madsen, Becker, and Thomas (1968) established that ignoring and showing approval could facilitate rules-following behavior when the rules themselves failed, and demonstrated that behavioral principles could be applied in a classroom. It remained to be seen if group contingencies could be applied with equal effect.

This type of project was undertaken by Greenwood, Hops, Delquardri, and Guild (1974). Through the use of an electric clock device (Cobb & Hops, 1973; Hops & Cobb, 1973; Packard, 1970) all of the students in reading and math had access to immediate feedback about the group's behavior. When all were following the rules, a signal went on and the clock recorded time. If a rule was broken, the light and clock went off. The amount of good behavior time was charted for the students to see.

The rules were fairly typical for school classrooms: (a) Look at the teacher when the teacher talks or gives directions. (b) Follow instructions. (c) Work quietly on assignments. (d) Raise hand for help or permission to talk. (e) Take turns in discussions. (f) When your work is done you may engage in a teacher-approved activity. The treatment conditions were varied so to determine each combination were most effective in providing classroom control.

The package of group rules, immediate feedback, group and individual consequences was judged to be the most powerful of the procedures tested. Rules with feedback was second best, and rules alone produced no observable effect on behavior. Although these immediate studies used no DRL systems, they demonstrate a necessary link between laboratory research and the application of theory in the classroom.

"Good Behavior Game"

Perhaps the most well-known of the DRL applications was the "Good Behavior Game" (Barrish, Saunders, & Wolf, 1969). In a class of 24 difficult students from the fourth grade, the teacher was instructed to make a mark on the board every time one of the 11 class rules were broken. By dividing the class into two teams, error scores for the two teams could be tallied during the day. The lowest rate team received victory tags, stars on a cumulative chart, 30 minutes of free time working on a special project, and the chance to line up first for lunch. The team which earned 20 or fewer marks in a week received a bonus; if the teams earned less than five erros in a day, both teams were awarded a bonus.

During the first period of the project, the team with the fewest marks won, unless both groups were below ten marks. In the second period, five or fewer marks were required to win. The last session was also the last day of school, and the researchers felt compelled to allow eight errors.

By providing reversal periods, the effects of the game could be studied. The results suggested that the game provided the intended effect. In fact, both teams "won" 82% of the time. A problem in this system was that one or two particularly crabby children could skew the group results. Hence, the possibility arose that many favorably-acting children could fail to be reinforced because of the actions of a vocal minority. Also, the teachers reported that a large amount of time was required preparing special projects to be used as reinforcers.

A replication was reported three years later. Medland and Stachnik (1972) used a group of 28 fifth graders. The class was divided into two teams during a 40-minute first period reading class. High school volunteers were trained to observe and operate a visual feedback system. When the students were following the class rules, a green light was on for all to see. If an error was spotted, a red light went on for at least 30" and stayed on for 30" following the last error. The red light signalled the teams to be careful.

The rules were typical, with one interesting addition. Class disruption, talking without permission, and being out of seat without permission were not allowed. However, if the teacher was out of the classroom and could not give permission, a child could raise a hand for five seconds, thus receiving permission. The idea was to eliminate impulsive responding and to help build self-control.

Building on the recognized problems encountered in the Barrish, et. al. (1969) study, a time-out precedure was initiated for the few children who consistently skewed the performance of the group. Any child who earned four or more personal marks in a day could be voted out of the class by the rest of the students. The misbehaving student would then spend the entire next day behind a screen. This seemed to have the desired effect.

The team which earned five or fewer error tallies received three minutes of extra morning recess. The team which received 20 or fewer marks in a week got a bonus the following Monday. The bonus consisted of special privileges while the opposing team was required to do school work. No mention was made of the losing team's quality of behavior during the bonus time.

A third replication a year later testified again to the effectiveness of the general procedure, and additionally attempted to determine the effective components of the game. Harris and

Sherman (1973) initiated the good behavior game in both a fifth and sixth grade class. The classes were observed twice per day during different subjects for observation times ranging from 60-100 minutes. Buzzers marked off one minute intervals sc that the fifth grade teacher could record errors. The sixth grade teacher required the use of recorders.

Prizes were available to the team with the lowest error score. The fifth grade was required to reach five or fewer marks; the sixth grade was required to reach four or less. Since these scores were for one class period, the total for the two periods during which the game was in session was 10 and 8 respectively. The prize--going home ten minutes early.

Again, the problem of a few extra-troublesome students appeared. A third team was created, consisting of those problem students. A rule was added requiring the losing team to stay after school five minutes for each mark over the DRL limit. On the first day of the new rule, Team #3 stayed after an extra 15 minutes. This team never stayed after again. Later, team #3 petitioned the group for re-incorporation, and team #3 was allowed to disband with no ill effects.

As a side note, the researchers observed that when students were allowed to play the game without the prize, misbehavior was reduced to 50% of the baseline measurement. Just competing for the scores seemed to have at least a partial reinforcing effect.

The effective components of the good behavior game were identified as: (a) dividing the class into competing teams, (b) consequences for team winning, and (c) specific criteria for winning. Although the misbehavior was reduced, follow-up measurements showed no gains in academic work. Curiously enough, when playing the game fewer math problems were done overall, but the accuracy of those problems increased. One component of the technique--peer harassment of the losing team--seemed to contribute to the overall effectiveness of the game. However, this aspect could be distasteful to some teachers.

Deitz Report

One of the more prolific users of the DRL schedule is S.M. Deitz. His 1974 report with Repp in the Journal of Applied Behavior Analysis documented the successful application of DRL with one 11-year-old trainable mentally retarded (TMR) boy in a special education class, 15 otherwise normal female high school seniors, and a class for TMR students described as "extremely disruptive." In all of Deitz's work, efforts were made to conduct accurate behavior counting sessions with reliability checks. The general procedure for these three studies was to record behavior during a baseline period, and to establish a reasonable DRL limit based on that series of observations. The reinforcement which

was to be delivered at the end of the treatment sessions varied from free time to candy. In all cases, the students were not aware if they had earned reinforcement until the end of the treatment conditions. A return to baseline conditions enabled the researcher to determine if the treatment was the major contributing variable.

In all three of the situations, the DRL schedule was successful in reducing the rate of the target misbehavior. Rarely were reinforcements missed. The groups differed on their response to removal of the DRL contingency. The TMR boy showed some recovery of the misbehavior, but not at rates which were observed during the first baseline. Perhaps some other environmental factors had begun to intervene. The senior high school girls and the TMR class returned nearly to baseline rates when the DRL contingency was removed.

Two significant factors appeared from this report. First, the ability of special education children to respond favorably to a no-feedback treatment condition suggested that the population for which the DRL schedule may be applicable was larger than once expected. The ability to understand time concepts and use language was apparently not a significant factor. Secondly, the treatment seemed to be very flexible with regard to the critical DRL limits and the type of misbehavior which could be approached.

Deitz's familiarity with the subject eventually led to an excellent paper summarizing the types of DRL and describing case studies to demonstrate each type. This particular report (1977) is summarized next, however the reader is guided to the original document for a complete discussion.

In this paper he described three distinct forms of DRL schedules. The first he called spaced responding. In spaced responding DRL, reinforcement was earned by separating responses with a minimum IRT. Most of the early animal work used spaced responding, and Deitz's case study (1977) was apparently the first attempt to use the system in an applied setting. The form of DRL typically used was what he called full session. This technique has had several applications. Here, reinforcement was applied for n or fewer responses within a given time interval. The critical number of responses was referred to as the DRL limit. A third form was called interval DRL. This system was a bit tricky because reinforcement was applied to an average IRT. The technique established a time interval based on the baseline observations. If the subject made only one error within that time interval, reinforcement ocurred. Upon observation of the second error, the clock reset. An example of the application of each type follows.

The Ss for the spaced responding DRL example were three boys between seven and nine years of age. They were enrolled in a self-contained class for behavior disordered children. The target behavior was described as inappropriate questioning. For example, the children would interrupt to relate information not related to the topic, attempt to get feedback about their work prior to the end of the assignment, demand explanations for work they demonstrated that they knew how to do, or request directions for routine class tasks.

The new system was explained to the children prior to beginning a treatment condition. The teacher tallied errors during a 30 minute block set aside for independent seatwork. Then the teacher used three stopwatches to record the amount of time which had passed since the last error for each child. If a minimum IRT (which was different for each child, based on an educated guess after analyzing the baseline observation) had not elapsed since the last error, the child was told that not enough time had passed since he had asked a question like that. Then the child was ignored. If the IRT was beyond the DRL limit, the teacher answered the question and gave verbal praise for waiting long enough. Good questions were handled as usual. Table 1 shows the results of the spaced responding experiment, with IRTa indicating the first DRL limit and IRTb indicating a second, more stringent DRL limit.

Table I

Spaced Responding Example

	Baseline	IRT-a	IRT-b
S_1	.36 rpm	.11 rpm	.05 rpm
S_2	.24 rpm	.06 rpm	.02 rpm
S_3	.15 rpm	.05 rpm	.02 rpm

The demonstration of full session DRL involved one 15-year-old educable mentally retarded (EMR) boy in a self contained tenth grade special class. This child had a tendency to speak without permission during a 55 minute lecture and discussion period. Here, the teacher used a hand counter to record the number of talk-outs per period. The student was unaware of his performance until the end of the session. Table 2 shows the results of the full session DRL case study.

Table 2

Full Session DRL Example

	Baseline	DRL	Reversal	DRL
$\bar{x}$ errors per 55 minutes	32.2	4.8	14.4	4.5

The demonstration of interval DRL concerned a six year old girl in a regular first grade. She was involved in speaking without permission, interruption, talking aloud to herself, and calling names. She was observed during the last 30 minutes before lunch. Using an educated guess at the DRL limit based on the baseline observations, the project was begun. The student was told that for each five-minute segment that had less than two talk-outs, she would receive one caramel. On the occurance of the second talk-out in a five-minute period, the clock would start over. The candy was given immediately upon completion of the interval in which it had been earned. The results of the multiple baseline design are summarized in Table 3.

Table 3

Interval DRL Example

	Baseline	DRL	Reversal	DRL
$\bar{x}$ errors per 30 minutes	9.8	2.3	10	1.5

Other DRL Experiments

A further demonstration of interval DRL was conducted by Deitz, Slack, Schwarzmueller, Wilander, Weatherly, and Hiliard (1978). In the first example, the subject was a seven year old boy in a class for learning disabled children. His extensive misbehavior was defined as follows: running, shoving, hitting children or the teacher, rolling on the floor, sliding under the desk, pounding on furniture, throwing objects, dropping or otherwise destroying objects, sliding furniture, standing on the furniture, jumping from chairs or desks, and yelling.

The baseline observation was used to establish a reasonable DRL limit. Each day the student was reminded of the class rules. A paper with 15 squares was taped to his desk, each square indicating a two minute interval. He received one gold star in a square for each two minute interval of one error or less. A second error reset the clock. Each star was later traded for one minute of playtime. The S was not specifically told of the timing system, however the clock and the reset was visible to him. Later, the interval was increased to three minutes.

The multiple baseline design showed the interval DRL system to be effective in reducing misbehavior. During resumption of baseline contingencies, the misbehavior increased, but at a rate which was noticably lower than the first baseline rate. Clearly, the system was working, and the teacher was reportedly pleased. Additionally no adverse side-effects were reported as one would expect if strict time-out were applied to such a child. As an example of the efficiency of the system, during the last treatment phase only once did he earn less than 100% of the possible reinforcement.

In a second example--a multiple handicap kindergarten--the problem was talk-outs. Two graduate students recorded the frequency of non-approved talking. Playtime at the sand table was offered to the children if they remembered to raise their hands for permission to talk. The teacher used a watch to mark off 20" intervals. For each error, a mark was placed on the board. On the occasion of a second mark in the interval, the clock was reset. Ten marks or less during show and tell resulted in play at the sand table. Later the intervals were set to 30" and then 45". Since the amount of time spent in show and tell varied, the number of acceptable errors varied to maintain a constant reinforcement ratio. Again, the DRL procedure was demonstrated to have the desired effect.

One characteristic of Dritz's early work was that the Ss were rarely informed of their accumulated scores until the end of the session. Hobbs, Holt, and Richardson (1977) wondered how well DRL would work when the scores were continuously available. The subjects in this study were 17 children in an elementary special education class. The mean IQ was 66, and the ages ranged from eight to eleven.

The target behaviors consisted of out-of-seat and talking without permission. The behavior was observed for 30 minutes in 15 second intervals.

Class rules were posted on the bulletin board. Then the students were told that if there were five or fewer rule violations in the period they would have access to a reinforcer of their choice. When an error occurred, the teacher had the student make a tally by their name so that the record was visible to all. The DRL procedure reduced rule violations to a level which was approximately 50% of the baseline rate.

An interesting variation in the application of DRL was noted in a study by Epstein and Repp (1978). The students were four boys and two girls in a classroom for behavior disordered children. All were of average intelligence and between the ages of six and nine. The target behavior was obscene language. This was defined as reference to: (a) body parts used for sex or elimination, (b) sexual or eliminative behavior or the products of this activity, and (c) uncomplimentary references to parentage. Both the teacher and the aide tallied those remarks for the entire school day, for forty consecutive days.

Each student who made less than the allowable limit of comments received 20 bonus tokens to use in the already established token economy. Tallies of the errors were placed on a chart for all to see, however the teacher did not discuss the tallies or admonish students. The DRL limit for the first phase was three, and each phase reduced the DRL limit by one until no errors were allowed if reinforcement was to be earned. The project ended on the last day of school.

The procedure proved to be effective. This helped carry the technique from previous work with normals, and mentally retarded individuals to the behaviorally handicapped. The variation of note in this procedure was the way in which the DRL limit was lowered to zero errors. At DRL-0, the schedule technically becomes DRO (see DRO chapter elsewhere in this publication). For students who may require a gradual transition to DRO, a gradually increasing DRL schedule may help.

Some readers may be confused at this point regarding interval DRL and DRO. If one is differentially reinforcing a competing behavior on an interval basis, one occurance of an error resets the timer; with interval DRL, the clock is reset on the second error. Since DRL is concerned with the reinforcement of a rate, two observations are required to provide a starting and stopping point for the timing. In DRO, reinforcement is applied for the absence of a response, not an average IRT (Deitz, et. al., 1976).

The practitioner may be interested in Epstein and Repp's (1978) alternative to the multiple baseline design. With the multiple baseline, the classroom teacher has the displeasurable task of watching improved behavior return to high rates so that the effectiveness of the intervention can be ascertained. The changing baseline design used in this study enables the researcher to observe if changes in the treatment result in changes in behavior, but without the concomitant increase in unwanted behavior for the participating teacher. A further discussion of this technique is available in the source document.

Summary and Conclusions

This discussion describes a body of literature filled with problems in methodology, statistics, and replication. Making comparisons across studies is difficult, and generalizing the results to humans is risky at best since most of the work used animal subjects. That almost 20 years passed between Ferster and Skinner's (1957) discussion and the beginning of Deitz's work with DRL in the early 70's can surely be chalked up to the confusion in the area, and the difficulty of turning the DRL studies into an applied technique.

We can be fairly certain in saying that the DRL approach will likely reduce certain target behaviors, subject to the usual qualifications. The target behavior needs to be of a type which can be identified and responded to consistently by school staff. From this standpoint, DRL may enable the practitioner to give teachers a system which already capitalizes on many teachers' tendencies to attend to the negative. Many of us have experienced the problem of having to train staff to reward positive behavior when the reinforcement history of the staff encouraged punishment of the negative. Generally, the intervention can be expected to proceed slowly if staff training must precede training of the target student. Since the typical DRL system counts errors, it may have great face validity with staff and require less "selling" than other schedules of reinforcement.

Additionally, when one considers the techniques commonly suggested for reducing behavior, one encounters some rather adversive techniques. Punishment, time out, and response cost all have ethical considerations connected with their application. In some states, improper application has already led to the involvement of the legal profession (Epstein, et. al., 1978). DRL offers a "positive" approach to the reduction of behavior.

The advantages of DRL, as distilled from the literature reviewed here, seem to be as follows. The technique has been shown to work well with many differing populations. Handicaps and age groups appear to be variables which can be overcome. The system is flexible enough to enable the teacher to place a DRL contingency near one student, or the entire class, with little additional effort. Group contingencies may be particularly interesting to those teachers who insist on treating all class members alike.

The technique develops appropriate behavior slowly. The student is not required to become perfect overnight. The other side of this same coin suggests that the DRL schedule requires staff to set reasonable limits. Because a certain amount of garbage behavior is allowed, the system may be viewed as "fair" by Ss and staff alike. A certain amount of human error is built in. Those who are put off by the mechanical aspects of some applications of behavioral technology may express more comfort with a DRL schedule.

When the counting techniques are made available to the students, a large amount of feedback is available in a short period of time. Except with full session DRL, where this information is not known until the end of the session, the student can quickly learn what is appropriate and what is not allowed. The arrival of the reinforcer or the resetting of the clock may say much.

Finally, DRL provides an alternative for those problem behaviors which one may not want to eliminate entirely. For example, in the study by Bowser (1977) the problem was over-enthusiastic group participation. The behavior was a problem only in rate and intensity. To eliminate class discussion would have been counter-productive. However, a reduction of the rate of behavior through the DRL system was just the intervention requested by the teacher.

There are obvious disadvantages. For example, if the target behavior were serious, perhaps leading to personal injury, a reduction in the rate would not be sufficient. The desired course of action would lead to a total replacement of the injurious behavior. In such a case, it may be legally sound to involve punitive consequences to avoid dangerous actions.

The literature has shown that in group contingent DRL, a few misbehaving students can disrupt reinforcement for many students who are behaving appropriately. There are some systems for dealing with these individuals, but the variety of systems may indicate that the best solution has yet to be found.

The errors found in all behavioral programs are available to the user of DRL. The strength and durability of the reinforcer needs to be considered, as well as the amount of staff time needed to prepare and supervise the reinforcement. Since most reinforcers will lose their strength over time, a variety may need to be at hand, increasing the work load on the staff. Additionally, if free time or early release is used, how will one answer the claim that these students are not receiving a full day's education? Can we actually show that the reduced amount of contact time is of a sufficiently higher quality to offset the difference?

Choosing the DRL system and the DRL limit should be done carefully. A DRL limit which is too severe can postpone the first reinforcement so excessively that the intended learning does not occur. If the rate of reinforcement is critical for the students in question, the highest rate will most likely occur in spaced responding and interval DRL. However, the timing requirements and the concomitant teacher involvement are greater with these two schedules. Full session DRL requires less teacher involvement, but the feedback is less, perhaps requiring the subjects to be able to mediate time well or otherwise follow a rather complex set of instructions.

If elimination of a behavior is intended, in certain cases it may be beneficial to begin with full session DRL, gradually increasing the DRL limit until DRL-0 is reached. At this point, the switch to DRO occurs easily and naturally for both the student and the change agent. The practitioner should note that DRL does provide intermittent reinforcement for negative behavior. This could provide unwanted maintenance effects for certain children. Or, if the child is of the type who requires clear signals, DRL could give a confusing message.

For example, full session DRL gives no feedback until the end of the session, and then the specifics in question cannot be separated from the condensed data. Interval DRL allows one error to pass, but on the occasion of the second error gives feedback to the student. Only spaced responding actually provides the opportunity to reinforce a response. Although this may be a disadvantage from the standpoint of feedback, from the standpoint of behavior generalization, spaced responding is probably the technique of choice.

The DRL procedure can be an effective and non-punitive way to reduce undesirable behavior to an acceptable limit. As with other behavioral techniques, judgment is required to apply the method to its best advantage. Since the research supporting the practical application of the schedule is conflicting and complicated, practitioners have avoided using DRL in favor of behavior reduction systems which were more clear. This paper should assist those who wish to begin tentative application of the technique, since promising results have been reported for a variety of problems observed in several subject populations.

References

Aitkin, W. C. The role of cues and feedback in the DRL performance of rats with septal lesions. (Doctoral dissertation, Georgia State University, 1974.) Dissertation Abstracts International, 1975, 36, 929-B. (University Microfilms #75-17,082)

Barrish, H. H., Saunders, M., & Wolf, M. M. Good Behavior Game: Effects of individual contingencies for group consequences on disruptive behavior in a classroom. Journal of Applied Behavior Analysis, 1969 1, 119-124.

Barry, M. A paired comparison method for assessing stimulus control with an application to DRL schedules. (Doctoral dissertation, University of California, Riverside, 1970). Dissertation Abstracts International, 1971, 32, 1259-B. University Microfilms #71-20,260)

Beer, B., & Trumble, G. Timing behavior as a function of amount of reinforcement. Psychonomic Science, 1965, 2, 71-72.

Bostwick, A.D. Comparison of the efficiency and durability of responding effected by two modified DRL procedures with humans. The Psychological Record, 1977, 2, 225-233.

Bowser, P. B. Reduction of classroom noise with a DRL reinforcement schedule. In Grimes, J. (ed.), Psychological Intervention: Case Studies in School Psychological Services, Volume 1. Des Moines, Iowa Department of Public Instruction, 1977.

Cobb, J. A., & Hops, H. Effects of academic survival skill training on low achieving first graders. Journal of Educational Research, 1973, 67, 108-113.

Cohn, M. U. Collateral drinking on the differential reinforcement of low-rate schedule: schedule and deprivation effects. (Doctoral dissertation, Ohio State University, 1978.) Dissertation Abstracts International, 1979, 39, 5101-B. (University Microfilms #7908126)

Davidson, R. S., & Bremser, R. F. Controlled alcoholic drinking--differential reinforcement of low rates of drinking. Behavior Modification, 1977, 1(2), 221-233.

Deitz, S.M. An analysis of programming DRL schedules in educational settings. Behavior Research and Therapy, 1977, 15, 103-111.

Deitz, S.M., & Repp, A. C. Decreasing classroom misbehavior through the use of DRL schedules of reinforcement. Journal of Applied Behavior Analysis, 1974, 6, 457-463.

Deitz, S.M., Slack, D. J., Schwarzmueller, E. B., Wilander, A.P.; Weatherly, T.J., & Hiliard, G. Reducing inappropriate behavior in special classrooms by reinforcing average interresponse times: interval DRL. Behavior Therapy, 1978, 9, 37-46.

Ellen, P., Makohon, L., & Richardson, W. R. Response suppression on DRL by rats with septal damage. Journal of Comparative and Physiological Psychology, 1978, 92(3), 511-521.

Epstein, M. H., Repp, A. C., & Cullinan, D. Decreasing "obscene" language of behaviorally disordered children through the use of a DRL schedule. Psychology in the Schools, 1978, 15(3), 419-423.

Farmer, J., & Schoenfeld, W. W. Interresponse times for the barpressing response of white rats on two DRL schedules. Journal of the Experimental Analysis of Behavior, 1964, 7, 119-122.

Ferster, C. B., & Skinner, B. F. Schedules of Reinforcement. New York: Appleton Century-Crofts, Inc., 1957.

Greenwood, R., Hops, H., Delquardri, J., & Guild, J. Group contingencies for group consequences in classroom management: a further analysis. Journal of Applied Behavior Analysis, 1974, 7(3), 413-425.

Harris, V. W., & Sherman, J. A. Use and analysis of the "good behavior game" to reduce disruptive classroom behavior. Journal of Applied Behavior Analysis, 1973, 6(3), 405-417.

Hobbs, T.R., Holt, M.M., & Richardson, R. Effects of a modified DRL schedule with special education students. Psychological Reports, 1977, 40, 311-314.

Holz, W.C., & Azrin, N.H. A comparison of several procedures for eliminating behavior. Journal of the Experimental Analysis of Behavior, 1963, 6, 399-406.

Holz W.C., Azrin, N.H., & Ulrich, R.E. Punishment of temporaly spaced responding. Journal of the Experimental Analysis of Behavior, 1963, 6, 281-290.

Hops, H., & Cobb, J.A. Survival behaviors in the educational setting: their implication for research and intervention. In Hamerlynck, L.A.; Handy, L.; & Mash, E. (eds.), Behavior Change: Methodology, Concepts, and Practice. Champaign, Illinois: Research Press, 1973.

Kapostins, E.E. The effect of DRL on word utterance. (Doctoral dissertation, Columbis University, 1961). Dissertation Abstracts International, 22(1), 334-335.

Kramer, T. J. The differential reinforcement of low rates and stimulus control. (Doctoral dissertation, Michigan State University, 1970). Dissertation Abstracts International, 1971, 31, 6941-B. (University Microfilms #71-11,895)

Kramer, T. J., & Rilling, M. Differential reinforcement of Low Rates: a selective critique. Psychological Bulletin, 1970, 74, 225-254.

Leibowitz, L. M. The effectiveness of two variants of the differential reinforcement paradigm in an alternative response context as a function of schedule of reinforcement and reinforcement history. (Doctoral dissertation, University of Maryland, 1974). Dissertation Abstracts International, 35(6)-B, 3023.

Lipinski, D. P. The effects of differential reinforcement on reliability and reactivity of self-recorders. (Doctoral dissertation, University of North Carolina, Greensboro, 1974). Dissertation Abstracts International, 35(4)-B, 1918-1919.

Madsen, C.H., Becker, W.C., & Thomas, D.R. Rules, praise, and ignoring: elements of elementary classroom control. Journal of Applied Behavior Analysis, 1968, 1(2), 139-150.

McGown, W. P., Spencer, W. B., & Neetz, R. An investigation of collateral wood-chewing as a time mediational device. Psychological Reports, 1977, 41, 1063-1069.

Medland, M.B., & Stachnik, T.J. Good behavior game: a replication and systematic analysis. Journal of Applied Behavior Analysis, 1972, 5(1), 45-51.

Packard, R. The control of "classroom attention": a group contingency for complex behavior. Journal of Applied Behavior Analysis, 1970, 3, 13-28.

Ransford, C.P. The effects of variations in the nature of the operant response on DRL performance in pigeons. (Doctoral dissertation, Wayne State University, 1973). Dissertation Abstracts International, 1974, 34, 5721-B. (University Microfilms # 74-11,149)

Shmuel , A. The relationship between conditioning history and the development of mediating behavior on DRL schedules. (Doctoral dissertation, The University of Rochester, 1974). Dissertation Abstracts International, 1974, 35, 557-558-B. (University Microfilms, #74-14,415)

Skinner, B.F. Contingencies of reinforcement: a theoretical analysis. New Jersey: Prentice-Hall, Inc., 1969.

Stein, N. Effects of reinforcement history on the mediation of human DRL performance. Bulletin of the Psychonomic Society, 1977, 9(2), 93-96.

Stein, N., & Landis, R. Differential reinforcement of low rates performance by impulsive and reflective children. Journal of Experimental Child Psychology, 1975, 19, 37-50.

Stein, N., & Landis, R. Effects of age and collateral behavior on temporaly discriminated performance of children. Perceptual and Motor Skills, 1978, 47, 87-94.

Thatcher, K. M. Cholinergic modification of DRL performance in normal rats and rats with lesions of the septum. (Doctoral dissertation, Ohio State University, 1975). Dissertation Abstracts International, 1976, 36, 4219-B. (University Microfilms # 76-3575)

Weisberg, P. Effects of reinforcement history on timing (DRL) performance in young children. Journal of Experimental Child Psychology, 1970, 9, 348-362.

Wood, S. Personal communication, October, 1978.

Modeling-Based Interventions with Children

by

Frank M. Gresham
Department of Psychology
Iowa State University

Research on using behavioral principles in the school and home to modify child behavior has virtually exploded in quantity, quality, and applicability. This explosion of knowledge can best be illustrated by the increased number of journals devoted exclusively to applied behavioral research. These include: Behavioral Assessment, Behavior Therapy, Behavior Research and Therapy, biofeedback and Self Regulation, Child Behavior Therapy, Cognitive Behavior Therapy, Journal of Applied Behavior Analysis, Journal of Behavior Therapy and Experimental Psychiatry, and School applications of Learning Theory.

Moreover, the three major journals serving the field of school psychology (Journal of School Psychology, Psychology in the Schools, and School Psychology Review) have published many articles concerning behavioral interventions in school settings. By far, the bulk of the research published within the past 10 to 15 years has been based upon the operant conditioning paradigm. Adapting modeling research for use in educational and/or home settings by school psychologists has been emphasized less.

We now have an expansive body of literature which suggests that modeling is an effective behavior-change strategy (Bandura, 1969, 1973, 1977). Modeling has successfully modified a variety of academic and social behaviors and has ameliorated certain anxiety-based disorders in children (e.g., phobias, fears, etc.). Modeling has also been used in a behavioral consultation format to change teacher behavior (Brown, Reschly, & Wasserman, 1974; Nagle & Gresham, 1979).

The purpose of the present chapter is to review the empirical research on modeling with children. The historical antecedents of modeling theory along with the theoretical bases of the modeling paradigm will also be reviewed. The review of the literature will be divided into two types: 1) basic research and 2) applied research. Applications of modeling with a wide range of behaviors, populations, and settings will be discussed. Behavioral assessment will be briefly reviewed to highlight the important parameters in identifying the measuring cognitive and motoric target behaviors. Finally, several case illustrations will be presented to provide the reader with realistic examples of how modeling can be used in home and school settings to ameliorate children's problem behaviors.

Theoretical Overview of Modeling: Basic Research

Historical Antecedents

Some of the earliest concepts of modeling go as far back as the late 19th (Morgan, 1896) and early 20th centuries (McDougall, 1908; Tarde, 1903). In general, these early theories viewed modeling as determined primarily by innate factors. Several years

later, with the advent of behaviorism (Watson, 1913), modeling was reconceptualized in terms of associative principles (Allport, 1924; Holt, 1931; Humphrey, 1927; Jones, 1924). Basically, these theories saw modeling cues as eliciting stimuli for matching responses, but did not explain how behavior might be acquired through the process of modeling (Bandura, 1969). Modeling was therefore viewed as a special case of classical or respondent conditioning in which the modeled response was a conditioned reflex.

Almost 30 years later, with the knowledge of operant reinforcement principles derived from Skinner's (1938) work at Harvard, modeling became a special case of operant conditioning. Perhaps the best empirical demonstration of the reinforcement-based conceptualization of modeling is found in the work of Neal Miller and John Dollard (1947) at Yale University. Miller and Dollard's explanation of the modeling phenomenon essentially states that modeling occurs because an observer receives direct positive reinforcement for matching a model's response. Skinner (1953) had an almost identical explanation for the modeling process. According to Skinner (1953), reinforcement is essential to learning a response via modeling.

The reinforcement-based view of modeling went virtually unchallenged until the early 1960's when Albert Bandura, a University of Iowa graduate, started his now classic work in the area of modeling at Stanford University. In a series of investigations (Bandura, 1962; Bandura, 1965b; Bandura & Huston, 1961; Bandura, Ross, & Ross, 1963; Bandura & Walters, 1959), Bandura and his associates demonstrated that direct reinforcement was not necessary for acqusition of behavior through modeling. Bandura successfully demonstrated that the observer does not have to perform the model's responses (response) nor does he/she have to receive direct reinforcement for matching responses (reinforcement). Moreover, days or weeks later, the observer does not have to be exposed to the model to perform those responses learned during modeling (discriminative stimuli). In Bandura's view, Skinner's exalted three-component paradigm of S^d R S^{r+} does not fully explain the acquisition of responses via observational learning.

From this brief historical overview, one can see that explanations of the modeling process evolved from a totally innate view in the late 1800's and early 1900's, to a classical conditioning view in the 1920's, to an operant view in the 1940's and 1950's, and finally to a cognitive view of the 1960's. An abundance of research in the 1970's for the most part supports Bandura's cognitive/symbolic position regarding acquisition and performance of modeled responses. The next section will provide a more detailed discussion of the role of reinforcement in the modeling process.

Role of Reinforcement

The term "modeling" has been referred to by a variety of terms including "imitation," "observational learning," "copying," and "vicarious learning." Very simply, modeling is learning responses or response patterns by observing another person (a model) engage in a behavior or behavior pattern. A critical difference between learning via modeling and learning via operant conditioning is that in modeling the observer need not perform the behavior nor receive direct consequences for his or her performance (Bandura, 1969; Kazdin, 1980).

In contrast, the operant conditioning paradigm predicts that learning will occur only if the response is directly reinforced, punished, or extinguished (Skinner, 1953). The operant and modeling paradigms essentially disagree on the value of direct reinforcement as the critical determinant of behavior and both theories have discrepant concepts of the reinforcement process.

Skinner (1953) views reinforcement as an almost automatic and "unconscious" response strengthener. This view of reinforcement stresses the value of immediate response consequences and minimizes or ignores the individual's awareness of the relationship between responses and consequences. Bandura (1977), on the other hand, has presented quite a different view of the reinforcement process. Bandura states that reinforcement has three basic functions: 1) informative function, 2) motivational function, and 3) reinforcing function.

Reinforcement serves an informative function in that it provides the individual with information about the effects his/her behavior has on the environment. Responses that are correct or that lead to reinforcement tell the individual that his/her behavior was appropriate. This leads the individual to formulate certain hypotheses about which behaviors are most appropriate in which settings. Conversely, responses which result in negative outcomes inform the individual that his/her behavior was inappropriate and lead the individual to generate hypotheses about which behaviors are inappropriate in which settings. One can readily see the emphasis Bandura places on the cognitive aspects of the reinforcement process and the person's awareness of what is being reinforced or punished.

Reinforcement can also serve a motivational function in that individuals come to create expectations that certain behaviors will lead to positive outcomes, other behaviors lead to negative outcomes, and still other behaviors will result in somewhat neutral outcomes. In Bandura's view, symbolic representation of reinforcement, in terms of prdictable outcomes, motivates individuals to change their behavior before the response occurs. Thus, reinforcement in this sense is largely under antecedent, rather than consequent control.

An example of reinforcement being under antecedent control is perhaps best illustrated by the purchase of insurance. Most individuals do not wait until their house burns or until they die to purchase adequate financial protection. Similarly, most residents of Iowa do not wait until the first winter snowfall to purchase snow shovels or snowblowers. In this sense, individuals take steps to prevent or avoid aversive outcomes (i.e., negatively reinforced behavior) or to increase the probability that behavior will be reinforced (e.g., saving money, investments, attending work regularly). Again, the critical issue in Bandura's conceptualization of the motivational function of reinforcement is the effect that anticipatory thought has upon behavior.

Reinforcement can also have a reinforcing function, but Bandura (1977) points out that reinforcement is not an automatic response strengthener. In fact, there is considerable evidence that behavior is not significantly affected by its consequences without one's awareness of what is being reinforced (Dulany, 1968; Spielberger & DeNike, 1966). Bandura (1977) maintains that reinforcement is really a misnomer since there is little evidence that it strengthens responses. In Bandura's view, reinforcement provides an effective means of regulating behaviors once they have been learned, but is an inefficient way of establishing them (e.g., via shaping). In this sense, the term reinforcement can more accurately be described as regulator rather then a reinforcer of responses.

The reader can readily see that Bandura provides a somewhat more comprehensive view of the reinforcement process than the traditional Skinnerian position. Reinforcement can have an informative, motivational, and/or a reinforcing (regulating) function depending upon the individual, the behavior, and the stimulus conditions under which behavior occurs. Symbolic or cognitive activity is a hallmark of Bandura's theory and has received increased emphasis in the behavioral camp (Meichenbaum, 1977). With this in mind, we will now proceed to a discussion of how responses are learned via modeling.

Modeling Processes

Learning through modeling provides an efficient way of acquiring new behaviors into the repertoire. As previously mentioned, exclusive reliance upon response consequences represents a somewhat inefficient way of learning the myriad of behaviors which individuals possess. Observation of modeled responses provides the observer with not only the requisite responses but also with an idea as to how these responses can be integrated into complex behavior patterns. To coin a hackneyed phrase, "a vivid demonstration of desired behavior is worth a hundred reinforcements of successive approximations."

Bandura (1969, 1977) states that there are essentially four processes which govern learning through modeling: 1) attentional processes, 2) retentional processes, 3) motor reproduction processes, and 4) motivational processes. Only two of these are necessary for learning a response via modeling: attentional and retentional processes. The latter two, motor reproduction and motivational processes, are necessary for the performance of responses learned through modeling.

This learning versus performance distinction is crucial in Bandura's social learning theory (SLT). SLT suggests that responses are learned primarily through stimulus contiguity and associated symbolic processes (i.e., modeling) whereas performance of these responses is regulated primarily by one's ability to perform the modeled behaviors and the incentives available for performing these responses.

For example, many cerebral palsied children cannot speak intelligibly because of the neuromuscular impairment existing concurrently with this disorder. Over the years, they have been exposed to competent models of appropriate speech, many can symbolically retain these examples of appropriate speech, and often have been provided with the proper incentives for producing correct speech. Why don't most of the cerebral palsied population produce "normal" speech? The answer of course lies in their inability to coordinate the neuromuscular functions necessary for correct speech (excluding cleft palate, dental malocclusions, etc.).

Similarly, one cannot consistently achieve scores in playing golf that the touring professionals do, in spite of ample exposure to the modeled stimulus (via television), attention to the modeled response, retention of the modeled pattern of behavior (left arm straight, meeting the ball, follow-through, etc.), and motivation to play golf well (operationally defined as purchasing expensive clubs, paying green fees, playing four times a week, etc.). Obviously, only a small percentage of the population consistently attains scores as low as touring professionals. Why? We do not know how to integrate these responses in a motor reproduction pattern sufficient to achieve consistent sub-par scores on the golf course.

A more empirical demonstration of the learning-performance distinction was provided by Bandura (1965) in which children observed a film model who exhibited novel physical and verbal aggressive behaviors. One group of children saw the model severely punished following aggressive behavior, another group observed the child being reinforced with tangibles and praise following aggressive behavior, and a third group saw the model receive no consequence for aggressive behavior.

On the post test measure, children who observed the praised and no consequence model displayed more aggressive behavior than the punished model. These results were predictable from SLT, however, an additional manipulation was added. Following post test assessment, children were offered incentives for reproducing the model's behavior. This introduction of incentives eliminated the performance differences that existed between the three groups. This suggested that all groups had learned equivalently, but performance of these responses varied as a function of vicarious punishment, reinforcement, and extinction, respectively.

School psychologists should remember the learning-performance distinction in evaluating children's behavior. Just because a child does not perform a response does not mean that he/she does not know the correct response. Admittedly, our most objective measure of learning is performance. However, we should be able to determine whether the child's failure to respond correctly is due to either a learning deficit or performance deficit.

One practical example can be found on the Comprehension subtest of the WISC-R. This author can think of several times when he probed for a two-point response and the child responded, "OK". After the standard examination, I have tested the limits on several Comprehension items by presenting them in a slightly different format or in a more relaxed, game-like atmosphere. Not surprisingly, the child sometimes came up with the two-point responses. Had I not tested the limits, I would have erroneously concluded that the child's failure to respond during the standard administration was due to a learning rather than a performance deficit.

Vicarious Experience

One of the most important variables in the modeling process is the notion of vicarious experience. Bandura (1969, 1973, 1977) maintains that direct reinforcement is not necessary for learning a response via modeling. However, a plethora of research has shown that learning of responses is facilitated when the observer sees the model being reinforced for certain behaviors. This process is known as vicarious (indirect) reinforcement. Likewise, observers who see a model's behavior punished will inhibit the observed behavior on future occasions. This is known as vicarious punishment. Similarly, observers who see a model receiving no consequence for certain behaviors will be less likely to reproduce the observed behavior. This is known as vicarious extinction. The related processes of vicarious reinforcement, punishment, and extinction are able to explain how a wide variety of behaviors are either acquired or inhibited across a wide range of stimulus conditions.

Bandura (1977) has set forth five functions or mechanisms by which vicarious experience controls behavior. One mechanism by

which vicarious experience controls behaviors is through its informative function. That is, observed consequences to others inform the observer that certain behaviors will lead to reinforcement, other behaviors will lead to punishment or aversive consequences, while others will lead to neutral or no consequences (extinction). The frequent recommendation by school psychologists for teachers to praise those who are on-task or who are behaving appropriately while ignoring the transgressor is an example of the informative function of vicarious experience. When a disruptive child observes his/her peers being reinforced for appropriate behavior, he/she will know which responses to perform in order to obtain reinforcement.

Another mechanism by which vicarious experience controls behavior is through its motivational function. Seeing others being reinforced can motivate others to perform similar behaviors. This differs from the above example in that the child may already know how to perform those behaviors which lead to reinforcement, but is not performing them (performance deficit). Direct reinforcement of the child's peers for appropriate behavior may serve to motivate the target child to adopt similar behaviors.

Vicarious experience also serves an emotional learning function. Models often display a variety of emotional reactions while receiving reinforcing or punishing consequences. Thus, a phobic child who observes a model experiencing positive emotional reactions while approaching and interacting with a feared stimulus is likely to model or adopt similar emotional reactions. These observed emotional reactions will often inhibit or extinguish anxiety reactions in the observer.

Vicarious experience can also be used to develop or change individual values (valuation function). Thus, children will likely adopt a model's values toward objects, events, or persons if they see these values being reinforced and will not adopt those values exhibited by models which are punished. One can readily see the potential of this valuation function in teaching regular class children to change negative values and attitudes toward handicapped children. Powerful modeling effects may be facilitated through the judicious use of modeling films which depict regular classroom kids exhibiting positive attitudes toward and interaction with handicapped children.

A final mechanism by which modeling impact upon behavior is through its influenceability function. Observers are more likely to respond to vicarious reinforcement if they have had previous exposure to models responding positively to rewards. Children who have consistently observed models receiving positive reinforcement are more likely to display similar behaviors than children who have observed models resisting reinforcement attempts (Ditrichs, Simon, & Greene, 1967). This has obvious implications for the classroom. Children who observe their classmates responding

favorably to teacher praise are likely to adopt similar behaviors. In contrast, children who observe certain obdurate peers resisting teacher reinforcement will be less likely to be affected by observational learning.

Types of Modeling

Although the basic modeling processes are the same, there are different types of modeling. Bandura (1977) states that the same basic processes are operative whether the behavior is conveyed through words either auditority (listening) or print (reading). this is known as verbal modeling. Modeling can also be conveyed visually through pictures (still or moving pictures) or live actions. These are known as symbolic and live modeling, respectively.

It should be noted that all forms of modeling are not equally effective. Some forms of modeling command more of the observer's attention than do others. For example, children are much more likely to attend to a narrated color movie presentation of how to cooperate with their peers than listen to an oral description of the same behavior. They are perhaps even less likely to attend to a written story or description of how to cooperate with peers. Attentional and retentional processes are the two key factors which determine learning responses via modeling. Thus, children are much more likely to pay attention to and remember vivid pictorial or live demonstrations of behavior than to verbal descriptions presented orally or via the printed word.

We will now turn to a brief discussion of six basic types of modeling. these include: 1) live modeling, 2) symbolic modeling, 3) abstract modeling, 4) covert modeling, 5) participant modeling, and 6) self modeling.

Live modeling. perhaps the most common form of modeling found in school settings is live modeling. In live modeling, the observer imitates the behavior of a model who is physically present in the same situation. For example, teachers who use pointed praise to certain children who are behaving appropriately are likely to observe an increase in the appropriate behavior of children who were formerly off-task or who were otherwise behaving inappropriately. Even though the teacher did not directly reinforce the offending children's behavior, it increased as a result of observing their peers receiving reinforcement. Vicarious reinforcement is also responsible for a great deal of misbehavior in classroom settings.

For example, the author observed one special education classroom (which shall remain nameless) in which the teacher gave a command for students to get in their seats and start working. Immediately after this command, two children asked to go to the bathroom. One their way out, the two students kicked the door open with their feet. The teacher responded in a shrill voice, "Don't kick the door open again!" Much to the teacher's surprise,

six other children asked to go to the bathroom within the next 10 minutes and all six kicked the door open with their feet on their way out. The teacher merely shrugged her shoulders and began teaching the remaining two (out of the original 10) children in the classroom. It is quite obvious what happened in this example. The behavior of the first two children was modeled identically by the six other children. As a result, only two children received instruction while the other eight were playing in the hall and/or the bathroom. The literature on live modeling will be more extensively reviewed in a subsequent section of the current chapter.

Symbolic modeling. Symbolic modeling is typically administered in the form of films or videotapes. The same cognitive processes (attention, retention, verbal and imaginal coding of responses, etc.) that occur in live modeling also occur in symbolic modeling. Thelen, Fry, Fehrenbach, and Frautschi (1979) identified five advantages that symbolic modeling has over live modeling.

One, the availability of filmed and videotaped media provides the opportunity to capture natural modeling sequences that would be difficult to create in school or clinic settings. Two, the psychologist/therapist has greater control over the content and sequencing of the modeling scene. Three, symbolic modeling allows for use of multiple models or repeated observations of the same model. Four, use of videotape technology allows for consistent reproduction of the same behaviors time after time. Five, more clients can be treated using symbolic modeling and thus effects a dramatic decrease in the psychologist's time once the films or videotapes have been produced.

The comparative studies which have been done suggests that symbolic modeling is equally as effective as live modeling (Bandura, 1965, 1973, 1977). The literature using symbolic modeling to change a variety of children's behaviors will be reviewed in a subsequent part of this chapter.

Abstract modeling. Many times observers model certain rules, principles, or strategies, but do not reproduce the specific responses they have observed. This is known as abstract modeling which derives its name from the process of the observer abstracting certain rules or hypotheses about how modeled behavior is governed. Much of the research concerning abstract modeling comes from the social learning research on language acquisition and concept formation (Zimmerman & Rosenthal, 1974).

For example, Bandura and Harris (1966) found that exposure to a model who produced passive constructions (The dog is being petted) significantly increased children's use of passive forms. After exposure to a model using passive constructions, children were post tested on different sets of nouns and produced stylistically similar, but not exact, passive constructions. This

suggested that the children were extracting the comon structural attributes or rules of the modeled responses.

Similarly, Rosenthal and Kellogg (1973) taught a simple equivalence concept to severely retarded adolescents using abstract modeling (via verbal rule cues). Goldschmid and Bentler (1968) taught Piagetian conversation of number, substance, and weight to a group of six-year-olds using abstract modeling. Moral reasoning and moral behavior may also be modified using abstract modeling. Kohlberg (1969) maintains that children's progression through the six stages of moral development is more or less fixed and is not influenced by modeling to any great degree. However, recent research suggests that Kohlberg's failure to modify moral judgments (Rest, Turiel, & Kohlberg, 1969) might have been due to artifacts of his assessment procedures (Chandler, Greenspan, & Barenbaim, 1973; Gutkin, 1972; Hatano, 1970).

Rushton (1976) reviewed a large body of literature on socialization and the altruistic behavior of children and concluded that relatively brief exposue to highly salient models can produce durable and generalized changes in the altruistic behavior of children. Several of the studies which Rushton (1976) reviewed demonstrated the acquisition of moral behavior (altruism, consideration of others' rights, helping and sharing, etc.) in children as young as two years of age. This calls into question Kohlberg's (1969) cognitive-developmental hypothesis concerning the immutability of his six-stage sequence of moral development.

Abstract modeling holds tremendous promise for school psychologists wishing to generalize appropriate behavior across stimulus conditions (classrooms, playground, school bus, etc.) and to maintain appropriate responding over time. If children can be taught the correct rules for appropriate behavior (e.g., don't talk when others are talking, I complete all my work, don't bother others who are trying to work, etc.) then behavior is much more efficient than trying to teach specific responses in specific settings, although this might be a necessary first step.

Covert modeling. Modeling can also be presented in imagery rather than via live demonstration or filmed format. Imagery-based presentation of modeling is known as covert modeling (Cautela, 1976). In covert modeling, clients image models performing certain responses rather than observing models performing responses. This is similar to emotive imagery (Lazarus & Abramovitz, 1962) in which fearful children are taught to imagine their favorite hero confronting a feared stimulus situation. Covert modeling differs slightly from emotive imagery in the sense that age-appropriate peers are imagined performing responses in covert modeling rather than favorite heroes (e.g., Superman, Batman, etc.). Unfortunately, most of the research using covert modeling has been conducted with adult populations (Cautela, 1976; Kazdin, 1978). Much more research is needed to establish the utility of covert modeling with child populations as well as to compare the relative efficacy of covert modeling with other types of modeling (live, symbolic, etc.).

Participant modeling. This technique is used mainly to treat debilitating fears and phobias. In participant modeling, the therapist models gradual approach behavior to the feared object (e.g., snakes, spiders, etc.) without experiencing adverse consequences. Afterward, the client is encouraged and physically assisted by the therapist in jointly performing graduated subtasks of increasing difficulty of previously threatening activities. Thus, participant modeling is a type of live modeling in which the client actually performs the modeled motoric responses made by the model.

In a therapy outcome study with a group of adolescent and adult snake phobics, Bandura, Blanchard, and Ritter (1969) found participant modeling to be more effective than symbolic modeling and systematic desensitization in reducing both phobic behavior and increasing positive affective and attitudinal responses toward snakes. One reason why participant modeling is likely to be more effective is because it not only involves exposure to a competent model but it also contains a strong social reinforcement component. That is, the therapist reinforces successive approximations to the desired terminal response. Although severe phobias are relatively rare in the school-age population (with the exception of school phobia), school psychologists can employ participant modeling to teach a variety of social skills such as assertiveness, social approach behaviors, expression of feelings, etc. It may be possible to use a school phobic's peer as a model to treat recalcitrant cases of school phobia via participant modeling.

Self modeling. In self modeling, subjects view videotaped or filmed sequences of their own behavior to bring about behavior change. Self modeling therefore is one form of symbolic modeling except that the subject views his/her own behavior rather than the behavior of models. Several advantages accrue from the use of self modeling. One, videotaped sequences can be filmed in the target child's natural environment (i.e., the school or home) thus promoting generalization. Two, behavior rehearsal of appropriate responding is a necessary component of self modeling. Rehearsing appropriate behavior is likely to facilitate behavior change (Lazarus, 1966). Three, a large body of research suggests that the more the observer perceives him/herself to be similar to the model, the greater the modeling effect (Bandura, 1969, 1973, 1977). The degree of model-observer similarity in self modeling is evident. The application of self modeling in treating behavior problems is presented in latter sections of this chapter.

Applied Modeling Research

Modeling technology and theory have been applied across a wide range of behaviors. The following section will review the applied research which has used modeling to modify 10 broad areas of problem behavior. These areas are: 1) social withdrawal/social isolation, 2) aggressive/disruptive/hyperactive behavior, 3) fears/phobias, 4) cognitive impulsivity, 5) academic-related behaviors, 6) test anxiety, 7) delay of gratification, 8) resistance to deviation, 9) creativity, and 10) social skills.

Social Withdrawal/Social Isolation

One rationale echoed by the proponents of mainstreaming is that placement of handicapped children into regular classrooms will result in the handicapped child imitating or emulating the appropriate social and academic behavior of his/her peers. Modeling theory (Bandura, 1969, 1977) and an expansive body of applied research suggests that this does not occur (Apolloni, Cooke, & Cooke, 1977; Cooke, Apolloni, & Cooke, 1977; Marburg, Houston, & Holmes, 1976; Peterson, Peterson, & Scriven, 1977; Synder, Apolloni, & Cooke, 1977; Strain, Shores, & Kerr, 1976).

Modeling effects simply do not occur unless specific teaching procedures are employed (e.g., calling attention to the model, reinforcing the model, using competent models, etc.). Thus, handicapped children who are physically placed into regular classroom settings are likely to be isolated from the mainstream of the classroom unless some type of programming is instituted.

Eleven studies are reviewed in which modeling has been used to increase rates of social interaction and/or to enhance sociometric status (Evers-Pasquale, 1978; Evers & Schwartz, 1978; Gottman, 1977; Gresham, 1979; Jakibchub & Smeriglio, 1976; Keller & Carlson, 1974; O'Connor, 1969, 1972; Strain, Shores, & Kerr, 1976). Ten of the 11 studies used symbolic modeling via film or videotapes and only one study (Strain et al., 1976) used live modeling in a classroom setting.

The pioneering study using symbolic modeling (SM) to ameliorate social withdrawal was done by O'Connor (1969) who showed a 23-minute modeling film to withdrawn preschoolers. The film depicted multiple models becoming increasingly involved in social interaction and begin reinforced for doing so. Control subjects viewed a 20-minute film. Children who viewed the modeling film significantly increased their rates of social interaction in a post test situation (i.e., the classroom), but no maintenance data were collected. In a subsequent study, O'Connor (1972) used the same modeling film with socially withdrawn preschoolers and found similar results and the level of social interaction was maintained at a three-week follow-up assessment. These findings have been replicated by others using the O'Connor (1969) modeling film (Evers-Pasquale, 1978; Evers & Schwartz, 1973, Evers-Pasquale & Sherman, 1975) or similar SM methodologies (Jakibchub & Smeriglio, 1976; Keller & Carlson, 1974).

Social interaction rates may be modulated by a child's perception of the reward value of his/her peers. Two studies have suggested that isolated children who are peer oriented (i.e., they prefer activities with peers) respond more favorably to modeling treatments than children who are nonpeer oriented (i.e., they prefer to play alone or to play with adults). Evers-Pasquale (1978) and Evers-Pasquale and Sherman (1975) found that peer-oriented isolates demonstrated significantly larger increases in social interaction rates after viewing O'Connor's (1969) modeling film than did nonpeer-oriented isolates. Gresham and Nagle (1980), however, found that the peer orientation factor was not a particularly powerful modulator of responsiveness to modeling in a group of isolated third and fourth-graders. Much more research is needed to determine the relative effects of peer orientation in determining responsiveness to modeling (see Evers-Pasquale, 1978 for a copy of the Peer Preference Test).

Narration has been shown to facilitate the effectiveness of modeling films. Bandura (1969, 1977) maintains that narration enhances attention to critical behaviors exhibited by the model and promotes verbal labeling of such behaviors.

Jakibchub and Smeriglio (1976) investigated the variable of film narration to determine the effects it had on modeled behavior. Identical modeling films were narrated either in the third person ("She is talking and playing with others") or first person ("I am talking and playing with others") for two groups of children. First-person narration was more effective in increasing social interaction rates than was third-person narration.

Two interpretations of these findings are plausible. One, the first-person narration could have increased the perceived similarity between the subjects and the models. Research indicates that the closer the similarity between the subject and the model--the greater the modeling effect (Bandura, 1969, 1977; Thelen et al., 1979). Two, the first-person narration could have resulted in higher levels of attention to the models' behavior which would enhance modeling effects. The results of the Jakibchub and Smeriglio (1976) study are consistent with the recent work in the area of cognitive behavior modification (Meichenbaum, 1977) which emphasized the efficacy of "self speech" in training social and academic-related skills.

There is some evidence to suggest that traditional symbolic modeling films may not be effective in increasing rates of social interaction in disadvantaged preschoolers (Geller & Scheirer, 1978; Gottman, 1977). Both of these studies were conducted with preschoolers enrolled in Head Start programs. Geller and Scheirer (1978) used three specifically prepared 10 minute videotapes showing white, middle-class models engaging in cooperative play and positive social interaction. Gottman (1977) used the previously described 23-minute O'Connor (1969) film. Neither study demonstrated significant differences in social interaction

rates between those who viewed the modeling films and those who viewed control films. The findings, however, should not be interpreted as conclusive evidence that SM will not be effective in increasing rates of social interaction in disadvantaged populations.

For example, since the models used in the films were middle-class, white preschoolers, the disadvantaged observers (mostly lower-class blacks) may not have attended to or retained the modeled behaviors. This model-observer dissimilarity could have weakened the modeling effect. Moreover, disadvantaged children may have perceived middle-class models as being more competent and, as a result, did not model their behavior. Most modeling research suggests that children and adults tend to imitate behaviors exhibited by a coping model more so than behaviors exhibited by a mastery model (Bandura, 1969, 1977; Thelen et al., 1979). Future research and applications using SM with disadvantaged populations should make efforts to achieve model-observer similarity and present coping rather than mastery models.

Live modeling also appears to be effective in increasing social interaction rates. Strain et al. (1976) used prompting and social reinforcement to target children to increase positive social interaction rates of behaviorally handicapped nontarget children. Rates of positive social interaction increased in both target and nontarget children suggesting that prompts and praise toward target children to interact socially had "spillover" effects (i.e., vicarious reinforcement) to nontarget children. These findings suggest that positively reinforcing children in classroom settings for socially appropriate interaction may result in non-reinforced children adopting those behaviors which they observed being reinforced. Caution should be exercised in extrapolating these results to other populations since handicapped children may vary tremendously in the degree of their imitative skills.

Aggressive/Disruptive/Hyperactive Behavior

Modeling has been effective in modifying behaviors which are aversive in quality and which are either potentially dangerous to others or which interfere with normal classroom or social functioning. It should be noted that modeling can inhibit as well as disinhibit behavior (Bandura, 1969). With behaviors such as aggression, disruption, and hyperactivity, school psychologists are concerned with inhibiting or decreasing behavior.

Gittelman (1965) used live modeling in a group counseling format to decrease the aggressive behavior of children. Children were asked to discuss and role play situations in which their aggressive behavior occurred. The therapist then modeled non-aggressive ways of handling conflict situations. The children

subsequently rehearsed nonviolent ways of dealing with conflict situations in roleplay formats. After treatment, subjects showed less aggression in naturalistic (classroom) situations. This study demonstrates how modeling can be combined with role playing and behavior rehearsal to decrease aggressive behavior.

Two studies used more of an abstract modeling approach to decrease aggressive and disruptive behavior (Bornstein & Quevillon, 1976; Camp, Blom, Hebert, & van Doornink, 1977). Remember that in abstract modeling, children are taught a general rule or principle to guide behavior rather than specific responses. Camp et al. (1977) modeled cognitive strategies to train aggressive children to answer four basic questions before responding in conflict situations. These questions were: "What is my problem?" "What is my plan?" "Am I using my plan?" "How did I do?" Treatment group children were taught to "think aloud" during a six-week training program. Experimenters modeled these four questions and answers to them using the "copy cat" game. Modeling was gradually faded and children subsequently planned strategies at a covert level. Cognitive self-guidance led to improved overall social behavior as measured by teacher ratings of aggressive behavior.

Using similar procedures, Bornstein and Quevillon (1976) reduced off-task and disruptive behavior of three preschool boys. Prompts to covertly rehearse strategies after training were provided to enhance generalization and maintenance of appropriate behavior. These prompts resulted in generalization to the classroom setting and maintenance of responding was documented 22.5 weeks after treatment. The use of abstract modeling to control aggressive responding merits much more applied research attention. School psychologists are in a primary position to further our knowledge of this technique with school-aged populations.

Two studies in this review have investigated the effects of aggressive modeling films on the behavior of mentally retarded children. Fechtner (1971) showed aggressive and nonaggressive, institutionalized retardates as "aggressive" or "friendly" television film. His results showed that the frequency of aggressive responses increased for both groups after the "aggressive" film and the frequency of friendly responses increased after viewing the "friendly" film. These effects, however, only occurred in a post test situation in the experimental room and did not generalize to the ward. One reason for these findings could be that the degree of dissimilarity between the modeled behavior (friendly or aggressive interaction with a Bobo doll) and subsequent behaviors in a naturalistic setting (i.e., on the ward with peers) was great which did not facilitate modeling effects.

To train "friendly" behaviors in the mentally retarded (e.g., sharing, cooperation, positive verbalizations, etc.) one should

develop modeling films depicting as closely as possible the desired behaviors. These behaviors should be made salient through verbal narration and through discrete modeling of desired responses. The amount and complexity of desired behavior should be kept at a minimum. This should promote attention and retention of modeled behaviors as well as enhance generalization and maintenance.

Talkington and Altman (1973) demonstrated differential modeling effects as a function of the severity of mental retardation. The authors found that mildly retarded children modeled significantly more behavior (aggressive and affectual) than severely retarded children after viewing a modeling film. These results suggest that severely and profoundly (S & P) retarded children do not have the attentional, retentional, or motor-reproduction processes necessary to derive significant benefits from symbolic modeling treatments.

Exposure to televised aggression has been shown to increase aggressive behavior whereas exposure to prosocial television programs has increased prosocial behavior. Since 80% of the programs on television average five violent episodes per program hour and children's cartoons average 25.1 violent episodes per hour (Bandura, 1973), exposing children to this kind of violence has generated some concern.

In perhaps the best designed study in this area, Freidrich and Stein (1973) selected 93 preschoolers (ages 3.8 to 5.5 years old) and assigned them to one of four conditions: 1) aggressive TV programs with cartoon characters (Batman cartoons), 3) prosocial TV programs (Mister Rogers Neighborhood series), and 4) neutral films (travelogues). Children were blocked on IQ (high, medium, low) and socioeconomic status (high, middle, low).

Results of this study showed that aggressive behavior increased for those children who viewed the aggressive films, but his was only true for those who were above the median in aggression at pretest. This suggests that exposure to televised violence only has an effect on those children who are already aggressive--in other words, exposure to symbolic violence disinhibits aggressive responding in aggressive children. The prosocial films increased prosocial behavior (cooperation, sharing, etc.) for all children, but had its greatest effect on high IQ subjects.

Results of the Freidrich and Stein (1973) study are instructive for school psychologists. Many times school psychologists recommend to parents that they can use access to TV as a reinforcer contingent upon appropriate behavior (i.e., "Premack Principle"). If the child is aggressive, exposure to aggressive TV programs may increase the child's aggression in school or the home. Other researchers have found similar results using aggressive and prosocial TV programs (Hapkiewicz & Stone,

1974; Stein, Friedrich, & Vodracek, 1972). A detailed discussion of the effects of televised violence on children's aggressive behavior can be obtained from the Government Printing Office in Washington, D.C. (Murray, Rubinstein, & Comstock (Eds.), 1972).

Two studies have used self modeling to decrease aggressive/-disruptive behavior. Davis (1979) used videotapes of an 11-year-old aggressive boy responding in a nonaggressive manner to conflict situations (name calling, physical aggression, etc.). Self modeling decreased the boy's number of fights at school as well as the frequency of his inappropriate responses to the teacher (cursing, angrily denouncing the teacher, etc.). By having the boy view videotaped sequences of his own behavior, modeling effects were particularly strong. Similar results were reported by Creer and Miklich (1970) using self modeling to decrease the frequency and intensity of temper tantrums in a 10-year-old asthmatic boy. Additional research is needed to determine the relative effectiveness of exposure to a model using a self versus a symbolic format (i.e., observing another person or model performing the behavior).

Modeling has also been used with hyperactive children to decrease aggressive and/or disruptive behavior. Goodwin and Mahoney (1975) showed three hyperactive/aggressive boys a short videotape of a boy coping with verbal assaults through the use of covert self-instructions. Self instructions were dubbed into the videotape. The therapist pointed out and had the subjects verbalize the coping responses made by the model. This technique brought about large increases in appropriate classroom behavior for all subjects. Perhaps the crucial variable in this study was the therapist calling attention to and having the subjects rehearse the coping strategies made by the model. Similar findings have been reported by others (Bugental, Whalen, & Hinker, 1977; Douglas, Parry, Marton, & Gargon, 1976).

Fears/Phobias

Within the last 10 years, there have been at leat 20 modeling studies published which have focused upon the reduction of children's fears (Graziono, DeGiovanni, & Garcia, 1979). Most research has dealt with common childhood fears (e.g., fear of dark, animals, water, etc.). Other modeling studies have focused upon less common fears such as fear of dental and surgical procedures. Only a few studies will be reviewed to acquaint the reader with the methodology and specific fears which have been reduced via modeling.

The general procedure in using symbolic modeling to reduce fears is to have children observe a model successfully approach and interact with feared stimuli. Both single and multiple models have been used with differential effectiveness. Bandura and Menlove (1968) used symbolic modeling to decrease children's

fear of dogs. One modeling film depicted a single child model interacting with dogs without adverse consequences and another film showed multiple models interacting with dogs in a variety of situations. Results of this investigation showed that the multiple model was more effective than the single model film at follow-up in reducing fear of dogs. Similar findings have been reported by others using symbolic modeling to treat children's fear of dogs (Hill, Liebert, & Mott, 1968), fear of snakes (Kornhaber & Schroeder, 1975), and fear of water (Lewis, 1974).

Modeling films have also been used to prepare children for dental or medical procedures such as surgery. For example, Melamed and Siegel (1975) used a 16-minute film of an initially fearful child gradually coping with the prospect of surgery and finally overcoming his fear. Children who viewed this modeling film showed significantly less "anxiety" (sweat gland activity, self-reported medical concerns, and overt anxiety behavior) than control children who did not view the film. Similar findings have been reported by other researchers in treating dental fears (Machen & Johnson, 1975), anesthesia fears (Vernon, 1974; Vernon & Bailey, 1974), and inoculation fear (Vernon, 1974). Although these studies are not typically encountered in school settings, they are of value to school psychologists who may work in pediatric settings or who consult with parents on a regular basis.

This author could find no studies which have used modeling to treat school phobia, a fairly common fear among kindergarten and early elementary school-age children. Based upon research with other fears, it is probable that modeling would be effective in alleviating school phobia. School psychologists are in a position to test this hypothesis.

Cognitive Impulsivity

Modeling has been used to decrease the level of impulsivity children display while performing certain cognitive tasks. Cognitive or abstract modeling has been used most often for the child who observes a model exhibiting discrete behaviors and verbalizing the strategy or rationale for emitting such responses (Hobbs, Moguin, Tyroler, & Lahey, 1980). Meichenbaum (1977) has listed five steps which are used in cognitive modeling to teach children to be less impulsive:

1. An adult model performs a task while talking to himself/herself out loud.

2. The child performs the same task under the direction of the model's instructions (overt, external guidance).

3. The child performs the task while instructing himself/herself aloud (overt self-guidance).

4. The child whispers the instructions to himself/herself while going through the task (faded, overt, self-guidance).

5. The child performs the task while guiding his/her performance via private speech (covert self-instruction).

One can readily see that the progression through these steps becomes more covert and self-regulating rather than relying upon overt, external-regulatory mechanisms.

Cognitive impulsivity is a behavioral dimension which describes children who tend to respond quickly without any deliberation in problem-solving situations (Hobbs et al., 1980). Most impulsive children have been identified from their short latencies and high error scores on the Matching Familiar Figures Test (MFFT). The MFFT is essentially a visual discrimination task in which a child has to select from an array of similar pictures one that matches the standard (Kagan, 1977). Children can be classified into four basic groups based upon their MFFT performance: 1) fast accurate, 2) fast, inaccurate, 3) slow, accurate, and 4) slow, inaccurate. Group 2, fast, innaccurate, defines those children who are impulsive (i.e., they have short response latencies and have high error rates). Several other psychometric instruments have been used to assess and evaluate the outcomes of cognitive modeling. these include: Porteus Mazes Tests, WISC-R Picture Arrangement, Raven Progressive Matrices, Conners Hyperactivity Scale, and the Impulse Control Categorization Instrument (ICCI).

One of the first demonstrations of the effectiveness of cognitive modeling was conducted by Meichenbaum and Goodman (1971). Five impulsive children observed an adult model verbalizing instructions during the performance of various sensorimotor and problem-solving tasks. The model's verbalizations consisted of questions about the task, answers to these questions, discussion of a correct approach for problem solution, comments on the response required during each step of the task, and self-reinforcement for correct problem solution. After two weeks of cognitive modeling/self-instructional training, significant treatment effects were observed on the Picture Arrangement (WISC) subtest, MFFT latency, and Porteus Mazes error scores. These differences (between experimental and control groups) were maintained at one-month follow-ups. Similar findings have been reported by others using live sociometrically selected peer models (Cohen & Przbycion, 1974) and filmed models (Ridbert, Parke, & Hetherington, 1971).

Two investigations have combined cognitive modeling with other treatment techniques to reduce impulsivity in learning disabled populations. Bender (1976) found that cognitive modeling plus self-verbalization training was more effective in prolonging response latencies on MFFT-like items than cognitive modeling

or self-verbalization training in isolation. MFFT error scores were unaffected by training. In a group of older learning disabled boys, Cullinan, Epstein, and Silver (1977) failed to replicate Bender's (1976) findings although all three treatment groups (cognitive modeling + self instruction, cognitive modeling, self instruction) were superior to controls on error scores at post test. Response latencies were unaffected by the treatments.

Some investigators have investigated the role of self reinforcement when combined with cognitive modeling. Nelson and Birkimer (1978) used techniques similar to the Meichenbaum and Goodman (1971) strategy with a group of implusive second- and third-graders. The self-reinforcement group was trained to self-reinforce ("Good," "That's right," etc.) while the other group was trained to self-verbalize the steps in problem solution. The self-reinforcement group showed fewer errors and increased latencies on the MFFT from pretest to psot test, but the groups were not significantly different at post test assessment.

A recent study pointed out the relative advantages of abstract (cognitive) modeling over concrete modeling in modifying the impulsive behavior of 8 to 12 year old "problem" children. Kendall and Wilcox (1980) used two variants of a cognitive-behavioral treatment: 1) conceptual or abstract modeling in which an adult modeled a general problem solving approach applicable to any problem and 2) concrete approach in which an adult modeled an approach to solving the problem at hand (finding the picture that did not match the others in an array of pictures). This study is exemplary not only because of the strategies used but also because of the range of outcome measures (Porteus Mazes, MFFT, Impulse Control Categorization Instrument, teacher ratings of classroom behavior, subject self-report, and therapist rating). Results of this study showed that conceptual (abstract) modeling was more effective than concrete modeling on several dependent measures (MFFT latencies, teacher ratings of self-control in the classroom, and teacher ratings of classroom hyperactivity). This suggests that children should be trained using a problem-solving approach that has applicability over a wide range of problem situations rather than training in solution of discrete, circumscribed problems.

Cognitive modeling appears to be an effective approach to solving cognitive impulsivity in children. Most studies have shown improvements on psychometric instruments; the MFFT in particular. Most studies only show improvement on MFFT latency scores, but few show substantial decreases in error scores. Moreover, the psychometric credibility of the MFFT has recently been called into question (Egeland & Weinbert, 1976). It remains to be demonstrated the effect that cognitive modeling has upon impulsive behavior in the classroom, although the Kendall and Wilcox (1980) study is suggestive. What school psychologists and teachers want to know is what effect does cognitive modeling and

self-instructional training have upon impulsive responding to reading, mathematical, spelling, and other academic stimuli encountered in classroom situations? School psychologists should begin answering these questions through applied research with impulsive children.

Academic-Related Behaviors

Modeling procedures have been used in the classroom setting to increase those behaviors related to academic achievement. Academic-related behaviors include such things as attending/on-task behaviors, in-seat behaviors, asking relevant questions concerning academic materials, and communication skills. Peer tutoring may also be viewed from a social learning theory or modeling standpoint. The use of modeling interventions with each of these target behaviors will now be reviewed.

Two studies in this review have used live modeling to incease the attending behavior of children in classroom settings (Broden, Bruce, Mitchell, Carter, & Hall, 1970; Kazdin, Silverman, & Sittler, 1975). Kazdin et al. (1975) used combinations of verbal and nonverbal approval with verbal prompts to increase the attentive behavior of nontarget mentally retarded children. Verbal approval consisted of teacher statements such as "Good, you're doing nicely!" "That's really good!" These were delivered to target children with the intention of increasing the attentive behavior of nontarget, adjacent peers. Nonverbal approval consisted of physical contact delivered by the teacher to target children (patting a child in an approving fashion).

Kazdin et al. found that vicarious effects (i.e., increase in attentive behavior of nontarget children) were produced only when nonverbal approval was preceded by a verbal prompt (e.g., "Dave, look at ."). A strict modeling interpretation of these findings would suggest that the nonverbal approval (reinforcement) accompanied by verbal prompts made the target subject's behavior salient to the adjacent nontarget subject. Because of this saliency, nontarget subjects attended to, retained, and easily reproduced the attending behaviors which led to reinforcement. An operant interpretation is equally plausible. That is, verbal prompts might have made the cues in the situation (i.e., discriminative stimuli) more salient which set the occasion for reinforcement. Whichever interpretation, it appears that nonverbal reinforcement to target children with the addition of verbal prompts is effective in increasing non-target children's attending behaviors. Similar results were reported by Broden, Bruce, Mitchell, Carter, and Hall (1970).

Five studies have used live modeling to increase the question-asking behavior of both "normal" and exceptional children (Arnold, Sturgis, & Forehand, 1977; Bondy & Erickson, 1976; Denney, 1975; Denney, Denney, & Ziobrowski, 1973; Zimmerman & Pike, 1972).

Question-asking is an academic task-related social skill which is positively correlated with academic achievement (Cartledge & Milburn, 1978).

For example, Zimmerman and Pike (1972) increased the question-asking behavior of 36 Mexican-American second graders through the use of modeling and reinforcement procedures. The children were exposed to models who ask questions germane to the context of activities and conversations. These authors reported that the combination of modeling plus rienforcement enhanced generalization of question-asking to naturalistic settings (classroom, home, etc.).

In a laboratory demonstration, Denney (1975) and Denney et al. (1973) used cognitive modeling to train normal elementary school children to ask constraint-seeking questions (i.e., general questions which allowed them to eliminate alternatives in a game of 20 Questions). These two studies suggested that cognitive modeling, in which the model not only modeled the questioning behavior but also provided a verbal rationale for doing so, was more effective than exposure to a model who simply modeled questioning behavior.

Bondy and Erickson (1976) increased the question-asking behavior of three groups of retarded children using modeling (Group 1), tokens (Group 2), or modeling plus tokens (Group 3). Modeling alone had only minimal effects on the rate of question-asking, while the modeling plus token group showed more rapid increases in question-asking rate. This suggests that modeling facilitates the effects of token reinforcement and is consistent with the findings of Zimmerman and Pike (1972). Arnold et al. increased the number of conversational on-topic questions of a 15-year-old retarded female using a combination of live modeling, verbal prompting, and social reinforcement.

These studies suggest that modeling is an effective strategy for increasing the rate of appropriate question-asking behavior in classroom and home settings. For retarded children, the asking of appropriate questions could set the occasion for reinforcement and facilitate peer acceptance.

One study reviewed used modeling to increase the frequency of in-seat behavior. Christy (1975) provided food and tangible rewards to six target preschool children for appropriate in-seat behavior. The six nontarget subjects did not receive reinforcement for in-seat behavior, but their rates of in-seat, aggressive, disruptive, and complaining behaviors were monitored. Tangible rewards and praise to target subjects increased the in-seat behavior of target peers. Moreover, no increases in aggressive, disruptive, or complaining behavior by nontarget peers were noted. This suggests that live modeling in the classroom does not elicit negative behaviors of nonreinforced peers, but rather leads to increases in those behaviors these children observe being reinforced. These findings are consistent with

the Broden et al. (1970) and Kazdin et al. (1975) studies which used vicarious reinforcement to increase attending behavior. This study should be particularly instructive to school psychologists who recommend tangible reward systems (token economies) to teachers.

Teachers are frequently relectant to use tangible rewards with only one or two children for fear that perceived discrepancies will have adverse effects on the behavior of peers (Christy, 1975). Although much more research is needed, there is to date little evidence that reinforcement systems for only a small number of target children have adverse effects on nontarget children. In fact, most evidence points in the opposite direction--children tend to model behaviors in the classroom they observe being reinforced.

Although not traditionally couched in a modeling framework, the whole area of peer tutoring may be considered from a social learning theory perspective. Several studies have demonstrated the beneficial effects of peer tutoring on spelling, language, mathematics, and reading skills (Cloward, 1967; Dineen, Clark, & Risley, 1977; Frager & Stern, 1970; Harris, Sherman, Henderson, & Harris, 1972; Harris & Sherman, 1973; Johnson & Bailey, 1974). A modeling conceptualization of peer tutoring suggests that tutees model academic and problem solving behaviors demonstrated by tutors. Moreover, recent evidence suggests that educational benefits also accrue for the tutor as well as the tutee.

For example, Dineen et al. (1977) used peer tutoring in a group of 9- and 10-year-old children in an ungraded, open classroom. These authors showed that tutoring a peer in spelling increased the tutor's own spelling accuracy nearly as much as being tutored by a peer. Thus, beneficial effects accrued as much or more to tutors as the tutees. Modeling effects were particularly salient in this investigation since tutor training consisted of modeling and role playing of appropriate tutorial skills. Although not specifically investigated, these results suggest that tutors derive beneficial effects from teachers who model appropriate teaching or tutorial skills. Use of student tutors offers teachers an attractive alternative to large-group instruction and frees them to devote more individual attention to students who are having more severe academic difficulties.

Test Anxiety

Modeling has been effective in reducing children's test anxiety. Some children experience unreasonable fear when exposed to testing situations which may be detrimental to their performance on tests. Mann and Rosenthal (1969) and Mann (1972) exposed test anxious adolescents to symbolic modeling videotapes of peer models undergoing systematic deesensitization for test

anxiety. The models gradually overcame their anxiety and did not exhibit fear at the conclusion of the desensitization hierarchy. Subjects exposed to the modeling films exhibited significantly less test anxiety than control subjects. It is unclear, however, whether or not this fear reduction generalized to naturalistic testing situations or maintained over time. Moreover, it is difficult to ascertain which component of treatment was responsible for anxiety rduction (i.e., modeling or desensitization).

Raskind and Nagle (1980) exposed test anxious children to a peer model undergoing a WISC-R examination. The model initially exhibited anxiety to the situation but gradually overcame his fear of the teting situation (coping model). Results of this study were disappointing since exposure to a coping model did not allay children's test anxiety nor did it increase their scores on any of the WISC-R subtests.

There are too litle data to date to evaluate the efficacy of modeling in reducing children's test anxiety. The most convincing data are those of Mann and Rosenthal (1969) and Mann (1972) who demonstrated anxiety reduction using systematic desensitization in a symbolic modeling format.

Delay of Gratification

Delay of gratification research consists of giving a child a choice between an immediate, but less valued reward compared to a delayed reward of greater value. In the typical paradigm (Mischel, 1958), a child is offered a penny (immediate reward) or a quarter (delayed reward). This "you can pay me now or you can pay me later" paradigm has been used in a variety of studies using preschoolers as well as elementary-age populations. Bandura and Mischel (1965) compared live modeling with symbolic modeling (a written transcript of the model's choice) on fourth- and fifth-grade children. Although exposure to either modeling condition significantly delayed children's gratification behavior, neither modeling strategy was superior to the other. Similar results have been reported by others (Mischel, Ebeson, & Zeiss, 1972; Moore, Michel, & Zeiss, 1976; Toner & Smith, 1977).

Translation of these findings into pragmatic applications by school psychologists is relatively simple. One way in which modeling of delayed gratification could be effective is in the context of token economies. Using either live or symbolic modeling, children could be taught to save tokens for a larger reward rather than to spend them on smaller rewards immediately after obtaining them. A second application could be in the realm of academic output. For example, children could be exposed to models who chose to complete five worksheets for a larger reward later on rather than completing one or two worksheets for a smaller immediate reward.

One characteristic of the juvenille delinquent population is their seeming inability to delay gratification (Ross, 1980). In the state of Iowa, much of our chronically disruptive population possess this same characteristic. School psychologists could begin to intervene with this population using modeling techniques to teach chronically disruptive children to behave less impulsively and to delay gratification.

Resistance to Temptation

In resistance to temptation studies, children are usually instructed to perform a task in which potential reinforcers (playing with a toy, watching TV, etc.) are available, but prohibited. Modeling has been used to teach children to resist temptation. Wolf (1973) exposed first- and second-grade children to a model who verbalized his intention not to play with a toy or to a model who did not talk. Children exposed to the verbalizing model deviated for a shorter period of time than those exposed to the nonverbalizing model. These findings point up the importance of narration in increasing the salience of modeled behavior (Jakibchub & Smerglio, 1976). Similar findings were reported by Kanfer and Zich (1974) who exposed children to a self-narrated versus an experimenter-narrated model resisting temptation (looking at toys). Other studies have used similar paridigms to teach children to resist cheating behavior (Monahan & O'Leary, 1971; O'Leary, 1968). Although these effects have been demonstrated in laboratory settings (a necessary first step), the resistance to temptation paradigm awaits extensive application in natural settings.

Creativity

Modeling can be one way of teaching children to be more creative. Bandura (1977) asserts that when individuals are exposed to diverse models, behaviors are not patterned after a single source, but rather observers combine aspects of various models into new amalgrams that differ from individual modeling sources. Bandura (1977) provides an example from the arts to demonstrate the phenomena of creative modeling"

". . . In his earliest works, Beethoven adopted the classical forms of Haydn and Mozart, thought with greater emotional expressiveness which forshadowed the direction of his artistic development. Wagner fused Beethoven's symphonic model with Weber's naturalistic enchantment and Meyerbeer's dramatic virtuosity to evolve a new operatic form. . ." (p. 48)

From Bandura's example, we can see how different sources of influence can be synthesized to produce creative behaviors. In this sense, creativity represents a form of abstract modeling in which diverse sources of influence are blended to create novel behaviors. Harris and Evans (1973) exposed individuals to

divergently thinking models and found that these subjects subsequently displayed more creative and innovative ideas than those not exposed to divergent models. Using combinations of modeling and reinforcement techniques, Baer and his colleagues (Baer, Rowbury, & Goetz, 1976; Holman, Goetz, & Baer, 1976) taught "creative" block building to children (i.e., form diversity and form density).

There is too little applied research with children to make any definitive statement regarding the efficacy of modeling in teaching creative responses. From a theoretical standpoint and from the available research, however, there is reason to believe that exposure to creative models enhances children's creative behavior. School psychologists with an interest or responsibilities in the area of giftedness can contribute much more to this knowledge.

Social Skills

There has been a recent surge of interest in the area of social skills training with children. Most of this interest was generated from a large body of literature which suggested that children with poor social skills have higher incidences of school maladjustment (Cartledge & Milburn, 1978), adult psychopathology (Cowen, Pederson, Babigian, & Trost, 1973; Gottman, 1977), and peer rejection (Bryan, 1978). Of particular interest to school psychologists, it has been shown that handicapped children have poor social skills which ultimately leads to social rejection by their "normal" peers. this holds true for mentally retarded (Ballard, Corman, Gottlieb, & Kaufman, 1977; Bruininks, Rynders, & Gross, 1974; Gottlieb & budoff, 1973), learning disabled (Byran, 1974, 1978; Bryan & Wheeler, 1972; Bruininks, 1978), and emotionally disturbed populations (Cowen et al., 1973; Morgan, 1977; Pekarik, Prinz, Liebert, Weintraub, & Neale, 1976).

Modeling techniques have been used to train children's social skills and represent some of the more powerful social skills training strategies.

Four studies have used live modeling to train social skills in handicapped children (Marburg, Houston, & Holmes, 1976; Morris & Dolker, 1974; Peterson, Peterson, & Scriven, 1977; Strain, Shores, & Kerr, 1976). Ages in these four studies ranged from preschool through late adolescence. Strain et al. (1976) directed prompting and social reinforcement to target children to increase positive social interaction rates of nontarget children (see section on social withdrawal/social isolation). Similarly, Morris and Dolker (1974) used live modeling to increase rates of cooperative behavior in six severely retarded children.

Modeling theory suggests that high prestige models are emulated more than low-prestige models (Bandura, 1969, 1977).

Peterson et al. (1977) tested this hypothesis on a group of mentally retarded and nonhandicapped preschoolers. Using either a handicapped or nonhandicapped model, Peterson et al. found that both handicapped and nonhandicapped preschoolers were more likely to imitate a nonhandicapped model. This finding was not due to differences in ability to model the behavior or sociometric popularity since these were controlled in the study. This suggests that nonhandicapped children appear to be more effective models of social behavior. These results should be interpreted parsimoniously since modeling research has marshalled strong evidence which indicates that coping models are more readily emulated than mastery models (see Thelen et al., 1979 for a discussion).

Another factor which appears to facilitate modeling effects is the use of multiple rather than single models. The advantages of using multiple models are: 1) the observer will probably select at least one model to imitate, 2) multiple exposures to the target behavior are provided, and 3) exposure to multiple models facilitates generalization (Bandura, 1977).

Marburg, et al. (1976) tested this hypothesis on a group of institutionalized mentally retarded children. Children in the multiple-model condition imitated significantly more behaviors (hugging a doll, play skills, etc.) than children in the single-model condition. While these data suggest that multiple models may facilitate modeling effects of simple behaviors, it remains to be demonstrated that this same approach would be successful with more complex social skills in more natural environments such as public school classrooms.

Mainstreaming is based upon the assumption that the handicapped child is exposed to multiple models which he/she will imitate in the classroom setting. The evidence to date does not support the assumption that handicapped children will automatically attend to, retain, or reproduce the positive social behaviors exhibited by their nonhandicapped peers.

The literature reviewed in previous sections of this paper (social withdrawal/social isolation and aggressive/disruptive/-hyperactive behavior demonstrates the efficacy of symbolic modeling on children's acquisition of social skills. More in-depth discussion of social skills assessment and social skills training can be obtained from the author (Gresham, 1980; Gresham, 1980; Gresham & Nagle, 1980).

Behavioral Assessment

The area of behavioral assessment has grown rapidly in recent years. This is evidenced most notably by the number of behavioral assessment texts on the market (Ciminero, Calhoun, & Adams, 1977; Haynes, 1978; Hersen & Bellack, 1976) as well as new journals

devoted exclusively to this technique (Behavioral Assessment and Journal of Behavioral Assessment). Moreover, recent issues of the School Psychology Review (Winter, 1980) and the Journal of Applied Behavior Analysis (Winter, 1979) have devoted entire issues to behavioral assessment. The purpose of this brief section is to discuss some basic issues in behavioral assessment as these relate to modeling interventions with children.

Nelson and Hayes (1979) define behavioral assessment as ". . . the identification of meaningful response units and their controlling variables for the purposes of understanding and altering human behavior." Behavioral assessment essentially is a five-stage process (Hawkins, 1979): 1) screening, 2) definition and quantification of target behaviors, 3) designing intervention, 4) monitoring of progress, and 5) follow-up assessment.

One can readily see that behavioral assessment cannot be separated from intervention. The beauty of the behavioral approach is that interventions are designed from the assessment process and rates, frequencies, or durations of target behaviors are continually monitored. Traditional assessment techniques used by most school psychologists (e.g., individual intellectual assessment, assessment of visual-motor skills, etc.) typically are not used to formulate or monitor interventions with target behaviors. Moreover, behavioral assessment techniques do not have the same statistical difficulties as do traditional, norm-referenced techniques (practice effects, reactivity due to repeated measures, etc.).

Behavioral assessment encompasses three response systems: 1) overt, motoric behavior, 2) cognitive-verbal behavior, and 3) physiological behavior. The first two (overt, motoric and cognitive-verbal behavior) are most frequently used by school psychologists. The specifics of these techniques will not be reviewed here but may be found in excellent articles by others (Alessi, 1980; Keller, 1980; Wilson, 1980).

For modeling-based interventions, school psychologists will need to use traditional behavior assessment techniques (frequency, rate, duration, etc.) as well as somewhat newer assessment strategies. This is particularly true of certain low-rate behaviors. Behavioral role-playing tests can be used to assess children's social skills before and after modeling interventions (overt, motoric behavior). Vogrin and Kassinove (1979) have developed a role-playing assessment strategy to determine the effects of a social skills traiing program. Shure and Spivack (1972, 1974) have developed interpersonal problem-solving tests for both pre-school and elementary-age children (cognitive-verbal behavior). Self-report and questionnaires also appear to be useful in assessing cognitive-verbal behaviors (Wilson, 1980).

A recent emphasis in behavioral assessment has been the social validation of behavior change after treatment. Merely increasing or decreasing the frequency of target behaviors do not ensure that these changes represent socially significant changes. Before intervening on target behaviors, school psychologists should solicit teachers, parents, and even peers perceptions of the target responses to verify the severity of the problem behavior. Likewise, these perceptions should again be solicited after intervention to document whether the changes in the target behavior are socially or educationally significant. Behavior changes can be validated by teacher and parent ratings, sociometric techniques, and independent judges' ratings of target behaviors before and after intervention. More in-depth discussions of social validity can be found elsewhere (Minkin, Braukmann, Minkin, Timbers, Timbers, Fixen, Phillips, & Wolf, 1976; Van Houten, 1979; Wolf, 1978).

Case Illustrations

The purpose of this section is to present several case illustrations of how modeling can be used to promote academic-related and social skills in the schools. Case examples of preschool, elementary, and secondary-age children will be provided.

Case 1. Mary is a 4-year-old preschooler whose teacher is concerned over her lack of social skills. When the school psychologist asked Mary's teacher to specify what she meant by "lack of social skills," she stated that Mary seemed to be very dependent. That is, she "clung" to the teacher, interacted little with peers, frequently asked for her mother, and sometimes cried when she did not receive individual attention.

Given these verbal descriptions of Mary's behavior, the school psychologist decided to collect baseline data on Mary's social behavior. The psychologist decided upon four measures of Mary's overt-motoric behavior: duration of "clinging" behavior, frequency of peer interaction, frequency of calls for mother, and frequency of crying behavior. The psychologist also solicited peer perceptions of Mary through a preschool sociometric rating scale as well as teacher ratings of Mary's classroom behavior. The latter two measures were gathered as a means of social validation. Based upon this behavioral assessment, the psychologist concluded that Mary exhibited relatively high rates of crying behavior, clinging behavior, and calls for mother. She also had a low rate of peer interaction. Mary's peers rated her low on the sociometric questionnaire and teacher ratings were low as well.

For intervention, the psychologist decided that a combination of live modeling, coaching, role playing, and social reinforcement would be effective. The psychologist advised the teacher to select several peer models who gained the teacher's attention

appropriately (raised hand, did not cling, did not cry, etc.). The teacher reinforced this behavior socially and prompted Mary to attend to those behaviors being modeled. After observation of these models, Mary was instructed to role play getting attention appropriately. The teacher coached Mary on these skills in the classroom and gave her feedback (positive and negative) on her performance. Mary role played these behaviors several times and received praise from both teacher and peers for appropriate responding. Social interaction skills were also modeled by peers and Mary was instructed to attend to these sequences. Mary also role played these skills and received social reinforcement. Other children were socially reinforced by the teacher for not clinging, not crying, and not calling for mother. These responses by Mary were ignored.

Data on Mary's target behaviors were collected for three weeks and the teacher and peer ratings were collected at the end of the third week. These data showed that Mary's clinging, crying, and calls for mother had decreased to zero. Her rate of social interaction increased substantially. Peer and teacher ratings of her social behavior also increased. From these data, it appears that the combination of live modeling, coaching, role playing, and social reinforcement was effective in decreasing Mary's inappropriate behaviors, increasing peer interaction, and enhancing peer and teacher perceptions of Mary's social behavior.

Case 2. Billy is an 8-year-old second grade learning disabled boy whose attending, independent-work, and group cooperation skills occurred at a low rate. Since these behaviors are conducive to academic achievement, the teacher asked the school psychologist what could be done to increase the rate of these behaviors.

The psychologist operationally defined attending behavior (eye contact with teacher during lecture, listening to teacher directions, keeping eyes on assigned tasks, etc.), independent work (completing math, reading, and spelling worksheets by himself, starting a new task when one was completed, etc.), and group cooperation skills (sharing materials, offering input, accepting group ideas, etc.) and took baseline data via interval and frequency recordings. The school psychologist also solicited peer and teacher perceptions of Billy's academic-related behavior (via sociometrics and teacher rating scales).

Based upon this behavioral assessment, the school psychologist noted that Billy displayed low rates of attending behavior, independent work, and group cooperation in academic activities. Moreover, on the sociometric rating scale, ppers did not prefer to work with him and no one chose him as a work partner. Teacher ratings of academic-related skills were also low.

Given this information about Billy's academic-related behavior, the school psychologist worked out with the teacher an intervention plan consisting of live modeling, role playing, behavior rehearsal, coaching, and social praise. To increase attending behavior, the teacher reinforced Billy's peers for being on-task, listening, and maintaining eye contact with her while she was talking. Several times during the day the teacher would stop instruction and give those individuals who were attending free time (e.g., five minutes). The teacher also used peer models of attending behavior in role playing situations and reinforced these models for attending behavior. Billy then was allowed to be a model for attending behavior and he role played and behaviorally rehearsed attending responses. The teacher socially reinforced all instances of attending behavior and gave Billy specific feedback.

Once Billy's attending behavior increased, the teacher began reinforcing other children for independent work. the same modeling, coaching, role playing, and behavior rehearsal sequences which were used to increase attending behavir were also used to increase independent work behavior. To teach academic group cooperation skills, the teacher again reinforced those children in the classroom for cooperative work. Several times these children were given free time to work on anything they wished (contigent upon cooperative behavior on academic tasks). Situations were contrived in a role playing format in which Billy and a group of his peers had to cooperate on an academic task to receive reinforcement. The teacher gave specific feedback to the group as well as Billy concerning how well they cooperated. These procedures were repeated several times each day. Billy was also instructed to observe other people cooperating in his classroom, on the playground, in his community, and on television. He was reinforced for each instance of cooperative behavior reported each day (via social praise, free time, etc.).

Billy's target behaviors increased dramatically after intervention and were maintained at three- and six-month follow-ups. Moreover, both peer and teacher perceptions of Billy changed as they saw him as being more cooperative, independent, and attentive.

Case 3. Tom is a 16-year-old high school student who is being integrated into regular high school classes for approximately three periods a day. Tom previously was enrolled in a self-contained classroom for mentally disabled students at another school. Tom's regular class teachers are concerned about the low degree of social acceptance that Tom has by his peers. Essentially, Tom finds himself in a more restrictive environment than the self-contained classroom because of low peer acceptance. The teachers stated that Tom is not necessarily rejected by his peers, but is merely ignored and excluded.

The school psychologist was called in by the guidance counselor to assist Tom's teachers with designing a program to enhance Tom's peer acceptance. The psychologist decided it would be a good idea to gather sociometric information on Tom in the three classrooms. Both peer ratings and peer nominations were used in each of the three classrooms. These data indicated that Tom was rated low by his peers and received no nominations for best friends, people you like to go to McDonald's with, people you like to talk with, etc. These sociometrics merely corroborated what the teachers, guidance counselor, and the psychologist already knew--Tom was not accepted well by his peers. The psychologist also conducted observations of Tom's behavior in his classes. These observations revealed that Tom would often sit by himself, offered few comments in class discussion, and would sometimes interrupt ongoing discussions when the topic revolved around sports--a topic in which he was relatively well-versed. It was obvious from these observations that Tom did not have the social skills to join the peer group nor were his peers making any efforts to have him join in.

To intervene, the school psychologist decided to see Tom twice a week individually for approximately 30 minutes each time for social skills training. In these sessions, Tom was taught how to make friends using modeling and coaching. Friendship skills included: 1) greeting others, 2) asking for and giving information, 3) extending an offer of inclusion, and 4) effective leave taking. The school psychologist modeled and role played these behaviors with Tom and reinforced correct performances. After several sessions, members of Tom's peer group were asked to come to the sessions so that Tom could practice these same responses with peers and to facilitate generalization. These peers were volunteers and were trained and briefed on the techniques used and responses selected. In addition to friendship-making skills, conversational skills were also taught using the same techniques. Tom was instructed to establish and maintain eye contact, making appropriate, on-topic responses, and initiate conversations on topics about which he had knowledge (i.e., sports). The psychologist modeled appropriate and inappropriate conversational skills.

Concurrent with these individual sessions, Tom's teachers prompted and reinforced Tom's participation in class. Peer models used in the role-playing sessions initiated conversations with Tom and received praise and other reinforcement from the teachers. Cooperative group activities were arranged by each of the teachers in which Tom was a member of work groups in all three classes. The group received praise and other reinforcing consequences for total group participation and cooperation. One teacher even let Tom present a short report on famous sports figures. In addition, a teacher ordered several films from the librarian which depicted famous athletes and movie stars working with and interacting with handicapped teenagers. Another teacher required his class to write an essay on how to accept differences in people and how they would feel if they had no friends at school.

The combination of these techniques increased positive social interaction between Tom and his peers. Tom became more involved in class discussion and initiated and maintained conversations with his nonhandicapped peers. His conversational skills increased dramatically and his peers began seeking Tom out for conversation. Peer nominations and peer ratings were collected at the end of the year and they revealed that Tom was better accepted by his peers. This program was continued the next school year with even more success.

Conclusions

Based upon this rather extensive review, it is apparent that modeling-based interventions are effective in teaching a wide variety of responses in school settings. School psychologists are in a primary position to both take advantage of existing modeling technology and to further knowledge through applied research. Operant and modeling strategies are particularly effective when used concurrently in intervention programs.

Modeling is perhaps most effective in teaching new skills whereas operant (reinforcement-based) strategies are most effective in maintaining those skills. Hopefully, school psychologists will take advantage of this powerful behavior-change technique and use it more frequently in interventions with children. Too often school psychologists get "locked-in" to one intervention approach without considering the range of techniques which can impact positively upon behavior. Having a large repertoire of intervention skills enhances our credibility and effectiveness, our own feeling of self-worth, and the future of children with which we work.

References

Alessi, G. J. Behavioral observation for the school psychologist: Responsive-discrepancy model. School Psychology Review, 1980, 9, 31-45.

Allport, F. H. Social psychology. Cambridge, Mass.: Riverside Press, 1925.

Apolloni, T., Cooke, S. A., & cooke, T. P. Establishing a normal peer as a behavioral model for developmentally delayed toddlers. Perceptual and Motor Skills, 1977, 44, 231-241.

Baer, D. M., Rowbury, T. G., & Goetz, E. M. Behavioral traps in the preschool: A proposal for research. In A. D. Pick (Ed.), Minnesota Symposia on Child Psychology, Vol. 10 Minneapolis: University of Minnesota Press, 1976.

Ballard, M., Corman, L., Gottlieb, J., & Kaufman, M. J. Improving the social status of mainstreamed retarded children. Journal of Educational Psychology, 1978, 69, 605-611.

Bandura, A. Influence of models' reinforcement contingencies on the acquisition of imitative responses. Journal of Personality and Social Psychology, 1965, 1, 589-595.

Bandura, A. Principles of behavior modification. New York: Holt, Rinehart, & Winston, 1969.

Bandura, A. Aggression: A social learning analysis. Englewood Cliffs, N.J.: Prentice-Hall, 1973.

Bandura, A. Social learning theory. Englewood cliffs, N.J.: Prentice-Hall, 1977.

Bandura, A., Blanchard, E. B., & Ritter, B. The relative efficacy of desensitization and modeling approached for inducing behavioral, affective, and attitudinal changes. Journal of Personality and Social Psychology, 1969, 13, 173-199.

Bandura, A., & Harris, M. B. Modification of linguistic style. Journal of Experimental Child Psychology, 1965, 4, 341-352.

Bandura, A., & Huston, A. C. Identification as a process of incidental learning. Journal of Abnormal and Social Psychology, 1961, 63, 311-318.

Bandura, A., & Menlove, F. Factors determining vicarious extinction of avoidance behavior through symbolic modeling. Journal of Personality and Social Psychology, 1968, 8, 99-108.

Bandura, A., & Mischel, W. Modification of self-imposed delay of reward through exposure to live and symoblic models. Journal of Personality and Social Psychology, 1965, 2, 698-705.

Bandura, A., Ross, D., & Ross, S. A. Transmission of aggression through imitation of aggressive models. Journal of Abnormal and Social Psychology, 1961, 63, 575-582.

Bandura, A., & Walters, R. H. Adolescent aggression. New York: Ronald Press, 1959.

Becker, S., & Glidden, L. M. Imitation in EMR boys: Model competency and age. American Journal of Mental Deficiency, 1979, 83, 360-366.

Bender, N. Self-verbalization versus tutor verbalization in modifying impulsivity. Journal of Educational Psychology, 1976, 68, 347-354.

Bornstein, P. H., & Quevillon, R. P. The effects of a self-instructional package with overactive preschool boys. Journal of Applied Behavior Analysis, 1976, 9, 179-188.

Broden, M., Bruce, C., Mitchell, M. A., Carter, V., & Hall, R. V. Effects of teacher attention on attending behavior of two boys at adjacent desks. Journal of Applied Behavior Analysis, 1970, 3, 199-203.

Brown, M. Reschly, D., & Wasserman, H. Effects of surreptitious modeling upon teacher classroom behavior. Psychology in the Schools, 1974, 11, 366-369.

Brown, D., Reschly, D., & Sabers, D. Using group contingencies with punishment and positive reinforcement to modify aggressive behaviors in a Head Start classroom. The Psychological Record, 1974, 24, 491-496.

Bruininks, V. L. Actual and perceived peer status of learning-disabled students in mainstream programs. Journal of Special Education, 1978, 12, 51-58.

Bryan, T. H. Social relationships and verbal interactions of learning disabled children. Journal of Learning Disabilities, 1978, 11, 107-115.

Bryan, T. S. An observational analysis of classroom behaviors of children with learning disabilities. Journal of Learning Disabilities, 1978, 7, 35-43.

Bryan, T. S. Peer popularity of learning disabled children. Journal of Learning Disabilities, 1974, 7, 621-625.

Bryan, T. S., & Wheeler, R. Perception of children with learning disabilities: The eye of the observer. Journal of Learning Disabilities, 1972, 5, 484-488.

Bugental, D. B., Whalen, C. K., & Henker, B. Causal attributions of hyperactive children and motivational assumptions of two behavior change approaches: Evidence for an interactionist position. Child Development, 1977, 48, 874-884.

Camp, B. W., Blom, G. E., Hebert, F., & van Doorninck, W. J. "Think Aloud": A program for developing self-control in young aggressive boys. Journal of Abnormal Child Psychology, 1977, 5, 157-169.

Cartledge, G., & Milburn, J. F. The case for teaching social skills in the classroom: A review. Review of Educational Research, 1978, 48, 133-156.

Cautela, J. R. The present status of covert modeling. Journal of Behavior Therapy and Experimental Psychiatry, 1976, 7, 323-326.

Chandler, M. J., Greenspan, S., & Barenbaim, C. Judgments of intentionality in response to videotaped and verbally presented moral dilemmas: The message in the medium. Child Development, 1973, 44, 315-320.

Christy, P. R. Does the use of tangible rewards with individual children affect peer observers? Journal of Applied Behavior Analysis, 1975, 8, 187-196.

Ciminero, A. P., Calhoun, K. S., & Adams, H. E. (Eds.) Handbook of behavioral assessment. New York: John wiley, 1977.

Cloward, R. D. Studies in tutoring. Journal of Experimental Education, 1967, 36, 14-25.

Cooke, R. P., Apolloni, T., & Cooke, S. A. Normal preschool children as behavioral models for retarded peers. Exceptional Children, 1977, 43, 531-532.

Cohen, S., & Przybycien, C. Some effects of sociometrically selected peer models on the cognitive style of impulsive children. Journal of Genetic Psychology, 1974, 124, 213-220.

Cowen, E. L., Pederson, A., Babigan, H., Izzo, L. D., & Trost, M. A. Long-term follow-up of early detected vulnerable children. Journal of Consulting and Clinical Psychology, 1973, 41, 438-446.

Creer, T. L., & Miklich, D. R. The application of a self-modeling procedure to modify inappropriate behavior. Behavior Research and Therapy, 1970, 8, 91-92.

Cullinan, D., Epstein, M. H., & Silver, L. Modification of impulsive tempo in learning-disabled pupils. Journal of Abnormal Child Psychology, 1977, 5, 437-444.

Davis, R. A. The impact of self-modeling on problem behaviors in school-aged children. School Psychology Digest, 1979, 8, 128-132.

Dineen, J. P., Clark, H. B., & Risley, T. R. Peer tutoring among elementary students: Educational benefits to the tutor. Journal of Applied Behavior Analysis, 1977, 10, 231-238.

Ditrichs, R., Simon, S., & Greene, B. Effect of vicarious scheduling on the verbal conditioning of hostility in children. Journal of Personality and Social Psychology, 1967, 6, 71-78.

Douglas, V., Parry, P., Marton, P., & Garson, C. Assessment of a cognitive training program for hyperactive children. Journal of Abnormal Child Psychology, 1976, 4, 389-410.

Egeland, B., & Weinberg, R. A. The Matching Familiar Figures Test: A look at its psychometric credibility. Child Development, 1976, 47, 483-491.

Elias, M. J. Helping emotionally disturbed children through prosocial television. Exceptional Children, 1979, 46, 217-218.

Evers, W. L., & Schwarz, J. C. Modifying social withdrawal in preschoolers: The effects of filmed modeling and teacher praise. Journal of Abnormal Child Psychology, 1973, 1, 248-256.

Evers-Pasquale, W., & Sherman, M. The reward value of peers: A variable influencing the efficacy of filmed modeling in modifying social isolation in preschoolers. Journal of Abnormal Child Psychology, 1975, 3, 179-189.

Freidrich, L. K., & Stein, A. H. Aggressive and prosocial television programs and the natural behavior of preschool children. Monographs of the Society for Research in Child Development, 1973, 38, No. 4.

Fechter, J. V. Modeling and environmental generalization by mentally retarded subjects of televised aggressive or friendly behavior. American Journal of Mental Deficiency, 1971, 76, 266-267.

Frazer, S., & Stein, C. Learning by teaching. The Reading Teacher, 1970, 23, 403-417.

Geller, M. I., & Scheirer, C. J. The effect of filmed modeling on cooperative play in disadvantaged preschoolers. Journal of Abnormal Child Psychology, 1978, 6, 71-87.

Gittelman, M. Behavioral rehearsal as a technique in child treatment. Journal of Child Psychology and Psychiatry, 1965, 6, 251-255.

Goldschmid, M.; & Benterl, P. M. Manual: Concept Assessment Kit - Conservation. San Diego: Educational and Industrial Testing Service, 1968.

Goodwin, W. E.; & Mahoney, M. J. Modification of aggression through modeling: An experimental probe. Journal of Behavior Therapy and Experimental Psychiatry, 1975, 6, 200-202.

Gottman, J. M. Toward a definition of social isolation in children. Child Development, 1977, 48, 513-517.

Gottman, J. M. The effects of a modeling film on social isolation in preschool children: A methodological investigation. Journal of Abnormal Child Psychology, 1977, 5, 69-78. (b)

Gottman, J.; Gonso, J.; & Rasmussen, B. Social interaction, social competence, and friendship in children. Child Development, 1975, 46, 709-718.

Gottman, J.; Gonso, J.; & Schuler, P. Teaching social skills to isolated children. Journal of Abnormal Child Psychology, 1976, 4, 179-197.

Graziano, A. M., DeGiovanni, I. S., & Garcia, K. A. Behavioral treatment of children's fears: A review. Psychological Bulletin, 1979, 86, 804-830.

Gresham, F. M. Assessment of children's social skills. Journal of School Psychology, 1980, 18, in press.

Gresham, F. M.; & Nagle, R. J. Social skills training with children: Responsiveness to modeling and choaching as a function of peer orientation. Manuscript submitted for publication, 1980.

Gresham, F. M. Social skills training with handicapped children: A review. Manuscript submitted for publication, 1980.

Gutkin, D. C. The effect of systematic story changes on intentionality in children's moral judgments. Child Development, 1972, 43, 187-195.

Hapkiewicz, W. G.; & Stone, R. D. The effect of realistic versus imaginary aggressive models on children's interpersonal play. Child Study Journal, 1974, 4, 47-57.

Harris, M. B., & Evans, R. C. Models and creativity. Psychological Reports, 1973, 33, 763-769.

Harris, V. W., & Sherman, J. A. Effects of peer tutoring and consequences on the match performance of elementary classroom students. Journal of Applied Behavior Analysis, 1973, 6, 587-597.

Harris, V. W., Sherman, J. A.; Henderson, D. G.; & Harris, M. Effects of peer tutoring on the spelling performance of elementary classroom students. In G. Semb (Ed.), Behavior Analysis and Education - 1972. Lawrence, Kansas: The University of Kansas Support Development Center for Follow Through, 1972, Pp. 222-231.

Hatano, G. Subjective and objective cues in moral judgment. Japanese Psychological Research, 1970, 12, 96-106.

Hawkins, R. P. The functions of assessment: Implications for selection and development of devices for assessing repertoires in clinical, educational, and other settings. Journal of Applied Behavior Analysis, 1979, 12, 501-516.

Haynes, S. N. Principles of Behavioral Assessment. New York: Gardner Press, 1978.

Hersen, M., & Bellack, A. S. (eds.) Behavioral assessment: A practical handbook. New York: Pergamon, 1976.

Hill, J. H., Liebert, R., & Mott, D. Vicarious extinction of avoidance behavior through films: An initial test. Psychological Reports, 1968, 22, 192.

Hobbs, S. A., Meguin, L. E., Tryoler, M., & Lahey, B. B. cognitive behavior therapy with children: Has clinical utility been demonstrated? Psychological Bulletin, 1980, 87, 147-165.

Holman, J., Goetz, E. M., & Baer, D. M. The training of creativity as an operant and an examination of its generalization characteristics. In B. C. Etzel, J. M. LeBlanc, & D. M. Baer, (eds.), New Developments in Behavioral Research: Theory, method, and application. Hillsdale, N.J.: Lawrence Eribaum Associates, 1976.

Holt, E. B. Animal Drive and the Learning Process. Vol. 1. New York: Holt, 1931.

Humphrey, G. Imitation and the conditioned reflex. Pedagogical Seminary, 1921, 28, 1-21.

Jakibchuk, Z., & Smeriglio, V. L. The influence of symbolic modeling on the social behavior of preschool children with low levels of social responsiveness. Child Development, 1976, 47, 838-841.

Johnson, M.; & Bailey, J. S. Cross-age tutoring: Fifth graders as arithmetic tutors for kindergarten children. Journal of Applied Behavior Analysis, 1974, 7, 223-232.

Jones, M. C. The elimination of children's fears. Journal of Experimental Psychology, 1924, 7, 383-390.

Kagan, J. Reflection - impulsivity: The generality and dynamics of conceptual temp. Journal of Abnormal Psychology, 1966, 71, 17-24.

Kanfer, F. H.; & Zich, J. Self-control training: The effects of external control on children's resistance to temptation. Developmental Psychology, 1974, 10, 108-115.

Kazdin, A. E. Behavior modification in applied settings (revised edition). Homewood, Illinois: Dorsey Press, 1980.

Kazdin, A. E. Covert modeling: The therapeutic application of imagined rehearsal. In J. L. Singer & K. Pope (Eds.). The Power of Human Imagination: New Techniques of Psychotherapy. New York: Plenum, 1978.

Kazdin, A. E.; Silverman, N. A.; & Sittler, J. L. The use of prompts to enhance vicarious effects of nonverbal approval. Journal of Applied Behavior Analysis, 1975, 8, 279-286.

Keller, H. R. Issues in the use of observational assessment. School Psychology Review, 1980, 9, 21-30.

Keller, M. F., & Carlson, P. M. The use of symbolic modeling to promote social skills in preschool children with low levels of social responsiveness. Child Development, 1974, 45, 912-919.

Kendall, P. C., & Wilcox, L. E. Cognitive-behavioral treatment for impulsivity: Concrete versus conceptual training in non-self-controlled problem children. Journal of Consulting and Clinical Psychology, 1980, 48, 80-91.

Kohlberg, L. Stage and sequence: The cognitive-developmental approach to socialization. In D. A. Goslin (Ed.), Handbook of Socialization Theory and Research, Chicago: Rand McNally, 1969.

Kornhaber, R., & Schroeder, H. Importance of model similarity in extinction of avoidance behavior in children. Journal of Consulting and Clinical Psychology, 1975, 43, 601-607.

Lazarus, A. A., & Abramovits, A. The use of "emotive imagery" in the treatment of children's phobias. Journal of Mental Science, 1962, 108, 191-195.

Lewis, S. A. A comparison of behavior therapy techniques in the reduction of fearful avoidance behavior. Behavior Therapy, 1974, 5, 648-655.

Machen, J., & Johnson, R. Desensitization, model learning, and the dental behavior of children. Journal of Dental Research, 1974, 53, 83-87.

Mann, J. Vicarious desensitization of test anxiety through observation of videotaped treatment. Journal of Counseling Psychology, 1972, 19, 1-7.

Mann, J., & Rosenthal, T. L. vicarious and direct counterconditioning of test anxiety through individual and group desensitization. Behavior Research and Therapy, 1969, 7, 359-367.

Marburg, C. C., Houston, B. K., & Holmes, D. S. Influences of multiple models on the behavior of institutionalized retarded children: Increased generalization to other models and other behaviors. Journal of Consulting and Clinical Psychology, 1976, 44, 514-519.

McDougall, W. An introduction to social psychology. London: Methuen, 1980.

Meichenbaum, D. H. Cognitive behavior modification: An integrative approach. New York: Plenum Press, 1977.

Meichenbaum, D. H., & Goodman, J. Training impulsive children to talk to themselves: A means of developing self-control. Journal of Abnormal Psychology, 1971, 77, 115-126.

Melamed, B., Hawes, R., Heiby, E., & Glick, J. Use of filmed modeling to reduce uncooperative behavior of children during dental treatment. Journal of Dental Research, 1975, 54, 797-801.

Melamed, B., & Seigel, L. Reduction of anxiety in children facing hospitalization and surgery by use of filmed modeling. Journal of Consulting and Clinical Psychology, 1975, 43, 511-521.

Miller, N. E., & Dollard, J. Social learning and imitation. New Haven: Yale University Press, 1941.

Minkin, N., Braukmann, C. J., Minkin, B. L., Timbers, G. D., Timbers, B. J., Fixen, D. L., Phillips, E. L., & Wolf, M. M. The social validation and training of conversation skills. Journal of Applied Behavior Analysis, 1976, 9, 127-140.

Mischel, W., Ebbeson, E. B., & Zeiss, A. R. Cognitive and attentional mechanisms in delay of gratification. Journal of Personality and Social Psychology, 1972, 21, 204-218.

Monahan, J., & O'Leary, D. Effects of self-instruction on rule-breaking behavior, Psychological Reports, 1971, 29, 1059-1066.

Moore, B., Mischel, W., & Zeiss, A. comparative effects of reward stimulus and its cognitive representation in voluntary delay. Journal of Personality and Social Psychology, 1976, 34, 419-424.

Morgan, C. L. Habit and instinct. London: E. Arnold, 1896.

Morgan, S. R. A descriptive analysis of maladjusted behavior in socially rejected children. Behavioral Disorders, 1977, 3, 23-30.

Morris, R. J., & Dolker, M. Developing cooperative play in socially withdrawn retarded children. Mental Retardation, 1974, 12, 24-27.

Murray, J. P. Rubinstein, E. A., & comstock, G. A. (Eds.). Television and social behavior. Vol. 2. Television and social learning. Washington, D.C.: Government Printing Office, 1972.

Nagle, R. J., & Gresham, F. M. A modeling-based approach to teacher consultation. Psychology in the Schools, 1979, 16, 527-532.

Nelson, W., Jr., & Birkimer, J. C. Role of self-instruction and self-reinforcement in the modification of impulsivity. Journal of Consulting and Clinical Psychology, 1978, 46, 183.

Nelson, R. D., & Hayes, S. C. The nature of behavioral assessment: A commentary. Journal of Applied Behavior Analysis, 1979, 12, 491-500.

O'Connor, R. D. Modification of social withdrawal through symbolic modeling. Journal of Applied Behavior Analysis, 1969, 2, 15-22.

O'Connor, R. D. Relative effects of modeling, shaping, and the combined procedures for modification of social withdrawal. Journal of Abnormal Psychology, 1972, 79, 327-334.

O'Leary, K. D. The effects of self-instruction on immoral behavior. Journal of Experimental Child Psychology, 1968, 6, 297-301.

Pekarik, E. G., Prinz, R. J., Liebert, D. E., Weintraub, S., & Neale, J. M. The pupil evaluation inventory: A sociometric technique for assessing children's social behavior. Journal of Abnormal Child Psychology, 1976, 4, 83-97.

Peterson, C., Peterson, J., & Scriven, G. Peer imitation by nonhandicapped and handicapped preschoolers. Exceptional Children, 1977, 43, 223-224.

Raskind, L. T., & Nagle, R. J. Modeling effects on the intelligence test performance of test-anxious children. Psychology in the Schools, 1980, 17, in press.

Rest, J., Turiel, E., & Kohlberg, L. Level of moral development as a determinant of preference and comprehension of moral judgments made by others. Journal of Personality, 1969, 37, 225-252.

Ross, A. O. Psychological disorders of children: A behavioral approach to theory, research, and therapy (2nd edition). New York: McGraw Hill, 1980.

Rosenthal, T. L., & Kellogg, J. S. Demonstration versus instructions in concept attainment by mental retardates. Behavior Research and Therapy, 1973, 11, 299,302.

Ridberg, H. E., Parke, R. D., & Hetherington, E. M. Modification of impulsive and reflective cognitive styles through the observation of film mediated models. Developmental Psychology, 1971, 5, 369-377.

Rushton, J. P. Socialization and the altruistic behavior of children. Psychological Bulletin, 1976, 83, 898-913.

Shure, M. B., & Spivack, G. Means-end thinking, adjustment, and social class among elementary school-aged children. Journal of Consulting and Clinical Psychology, 1972, 38, 348-353.

Shure, M. B., & Spivack, G. Preschool Interpersonal Problem-Solving (PIPS) Test: Manual. Philadelphia: Department of Mental Health Services, Hahnemann County Community Mental Health/Mental Retardation Center, 1974.

Skinner, B. F. The behavior of organisms. New York: Appleton, 1938.

Skinner, B. F. Science and human behavior. New York: Macmillan, 1953.

Stein, A. H., Freidrich, L. K., & Vondracek, F. Television content and young children's behavior. In J. P. Murray, E. A. Rubinstein, and G. A. Comstock (Eds.), Television and social behavior. Vol. 2. Television and social learning. Washington, D.C.: Government Printing Office, 1972, Pp. 202-317.

Strain, P. S., Shores, R. E., & Kerr, M. M. An experimental analysis of "spillover" effects on the social interaction of behaviorally handicapped preschool children. Journal of Applied Behavior Analysis, 1976, 9, 31-40.

Synder, L., Apolloni, T., & Cooke, T. P. Integrated settings at the early childhood level: The role of nonretarded peers. Exceptional Children, 1977, 43, 262-266.

Talkington, L. W., & Altman, R. Effects of film-mediated aggressive and affectual models on behavior. American Journal of Mental Deficiency, 1973, 77, 420-425.

Tarde, G. The laws of imitation. New York: Holt, 1903.

Thelen, M. H., Fry, R. A., Fehrenbach, P. A., & Frautschi, N. M. Terapeutic videotape and film modeling: A review. Psychological Bulletin, 1979, 86, 701-720.

Toner, I., & Smith, R. Age and overt verbalization in delay-maintenance behavior in children. Journal of Experimental Child Psychology, 1977, 24, 123-138.

Van Houten, R. Social validation: The evolution of standards of competency for target behaviors. Journal of Applied Behavior Analysis, 1979, 12, 581-591.

Vernon, D. T. A. Modeling and birth order in responses to painful stimuli. Journal of Personality and Social Psychology, 1974, 29, 794-799.

Vernon, D. T. A., & Bailey, W. The use of motion pictures in the psychological preparation of children for induction of anesthesia. Anesthesiology, 1974, 40, 68-72.

Vogrin, D., & Kassimove, H. Effects of behavior rehearsal, audiotaped observation, and intelligence on assertiveness and adjustment in third-grade children. Psychology in the Schools, 1979, 16, 422-429.

Watson, J. B. Psychology as a behaviorist views it. Psychological Review, 1913, 20, 158-177.

Wilson, C. C. Behavioral Assessment: Questionnaires. School Psychology Review, 1980, 9, 58-66.

Wolf, M. M. Social validity: The case for subjective measurement or how applied behavior analysis is finding its heart. Journal of Applied Behavior Analysis, 1978, 11, 203-214.

Wolf, T. M. Effects of televised modeled verbalizations and behavior on resistance to deviation. Developmental Psychology, 1973, 9, 51-56.

Zimmerman, B. J., & Pike, E. O. Effects of modeling and reinforcement on the acquisition and generalization of question-asking behavior. Child Development, 1972, 43, 892-907.

Zimmerman, B. J., & Rosenthal, T. L. Observational learning of rule-governed behavior by children. Psychological Bulletin, 1974, 81, 29-42.

Precision Teaching:

A Behavioral Approach to the Assessment of Learning

by

James P. McLallen and David Schoemer

Area Education Agency 9

Introduction

As psychologists operating in schools, we search for ways to improve our services to children, teachers and administrators. We rarely provide direct instruction to children, yet are called upon to provide teachers with strategies which we believe help children learn effectively. Often we fall back on standardized testing as a means of assessing a youngster's ability and achievement. Standardized testing has as an aim comparing one student's performance with a large number of students his/her age to see where he/she falls on the normal curve. This is done so that we can then determine whether or not that student meets the arbitrary criteria as mentally disabled, learning disabled, or some other disability category.

For the most part, standardized testing does this job well. Standardized testing was not meant to provide instructional starting points or accurately describe a student's precise learning problem. As a profession, school psychologists encounter difficulty when trying to stretch standardized test results into classroom recommendations. We have all had that uneasy feeling when we recommend to the teacher some general suggestions based upon test results which indicate a "visual-motor integration problem"; or, that a student is learning disabled because he/she is two years below grade level in reading, as determined by the Woodcock.

A more effective and efficient method of assessment which school psychologists can use to consult with teachers is entitled "precision teaching." The purpose of this chapter is to introduce precision teaching as a tool for use by school psychologists, and most importantly, by teachers.

Precision teaching is a growing set of procedures that guide teachers and learners in finding combinations of environmental events which affect learner's performance rate. Precision teaching is not a method of teaching nor a version of behavior modification. Precision teaching is a way to plan, use, and analyze any teaching method or technique. Precision teaching provides: (1) a precise means of measuring performance on a continuous basis; (2) detailed records of behavior charts; (3) a behavioral formula for use in analysis and programming, and; (4) techniques for interpreting the charted records. The educational accountability of precision teaching is found in how we are doing (continuous measurement) rather than how we have done (pre/post tests).

Some of the fundamentals of precision teaching grew from the work of B.F. Skinner in the 1940's and 50's. The entire concept of precision teaching was initiated by Ogden R. Lindsley and his students about 1965 at the University of Kansas. His intent was

to refine and extend the techniques of operant conditioning and behavior modification so they could be used in measuring performance change in academic behavior. Due to its flexibility, precision teaching can be used to measure almost any area of academic progress.

Since its inception 16 years ago (Lindsley, 1964), precision teaching has acquired many adherents. Recently, however, the growth and development of precision teaching has been given substantial impetus by the passage of P.L. 94-142, the "Education for All Handicapped Children Act". Lovitt (1978) observes that the law requires that records be kept of the child's progress and how he/she is responding to teaching strategies. Precision teaching techniques allow for fulfilling the requirements of the law by:

A. Concise definition of student problems and evaluation of IEP goals.

B. Meaningful communication between professionals and with parents.

C. Increased pupil involvement with his/her own learning.

D. Nondiscriminatory assessment.

Labels like "learning disabled", "emotionally disturbed" and "mentally retarded" do very little to accurately describe an individual child's problem nor do they provide a child's teacher with meaningful solutions (Alper et al, 1973; Cohen, Martin, 1971; Bradfield, Criner, 1969). In choosing precision teaching procedures, the teacher must specify measurable outcomes. This clarifies the focus of instruction and reduces the guesswork involved with whether or not a student has mastered a particular skill. Since instructional outcomes are now specific and observable, IEP goals can be clearly defined and student progress accurately assessed (Alper and White, 1971).

The standard behavior chart (Lindsley, 1964) improves the accuracy and speed of communication between those responsible for providing a child with an education and the child's parents. Parents and professionals can see at a glance if a child is making progress. In addition, pupil involvement is enhanced through precision teaching. "When a student charts his own performance, he sees his changes immediately....By doing so he becomes responsible to and for himself. He competes with his previous frequencies and not his peers. He figures out ways to improve his performance and consequently learns a great deal about himself while improving his personal management skills." (Haughton, 1971)

Precision teaching learning assessment is nondiscriminatory. Any single score provides a performance measure for a child on a given skill. That performance measure may or may not be discriminatory. A series of scores or frequencies presents a "learning picture." Such learning measures are sensitive to the development of children but rather insensitive to their racial background (Lovitt, 1970).

Research

Precision teaching techniques have been used with various exceptional populations since 1964 including the severe and profoundly handicapped, mentally disabled, learning disabled, behaviorally disordered, and regular education classroom children. Precision teaching presents a way for thoroughly and systematically evaluating instructional potential. Compliance-non--ompliance studies at the University of Washington's Experimental Education Unit with severe and profoundly retarded students have shown that different learning stages can be identified from charted data. From this analysis of learning pictures it was found that rules could be generated to provide guidelines for instructional changes when performance falters. These rules and stages of learning will be discussed in a later section of this chapter. It was also discovered that changes in the type of instruction were usually more effective than changes in the level of instruction. Another interesting finding was that experienced teachrs consistently underestimated the performance level of their students when compared to actual charted performances (Haring, 1976).

Maggs (1973) explored the persistent notion among educators that handicapped children learn more slowly and thus need slower teaching. It has been noted to the contrary that gradually restricting the time available for performance with educably retarded students improved academic performance (Ayllon et al, 1976).

The impact of precision teaching on learning disabled populations has been varied and illuminating. In a year long project involving 22 learning disabled and behaviorally disordered children, Bradfield and Criner (1971) found that of the 122 precision teaching projects conducted, "In almost every case regardless of the skill or behavior area, all of the children in the project responded positively to precise behavior management."

Johnson (1971) found precision teaching techniques equally successful for academic and behavioral pinpoints. A point system instituted to control student "yawns" showed marked improvement on the standard behavior chart. Charting also acted as a motivator. As the children progressed and increased their performance, they appeared to gain in "self-confidence".

In a more detailed analysis of the effectiveness of precision teaching, 1200 kindergarten through third grade students were screened and 100 identified as having basic "tool skill" deficits in reading, mathematics, and language arts. In a pre-post test design, experimental and control groups were matched on the basis of family income. Of the 19 experimental/control comparisons analyzed, 14 of the experimental groups demonstrated significantly more improvement (p. 05). Family income level did not enter in as a factor (Beck, 1979).

Research involving whole regular education classes have demonstrated precision teaching's usefulness to regular education. Beck (1979) published data comparing experimental and control classes after one, two, and three years of treatment. The results indicate that after three years of intervention, the experimental first grade students had significantly (p. 05) higher reading achievement and reading probe scores than did the controls. The experimental second grade students had significantly higher (p. 05) reading and math scores on both achievement tests and on probes. The experimental third grade students showed significantly higher (p. 05) scores on math probes and math achievement.

In the same publication, Beck presents cross-sectional data on fourth grade students on the Iowa Tests of Basic Skills in reading and math between 1974 and 1977. At the end of the three year treatment, the fourth grade experimental students demonstrated a 24 percentile point difference over the controls in reading; and a 32 percentile point difference over the controls in math.

Because precision teaching is an efficient and economical measuring system, it has been easily adapted for use outside the classroom. Speech and language therapists have found precision teaching successful in measuring preschool language performance (Hanby, 1974 SST), articulation and stuttering (Ullman, Sutherland, Mowrer, 1969); and vocal abuse (Johnson, 1978). Galloway and Galloway (1971) employed precision teaching methods in teaching parents how to precisely manage their children.

The research reviewed, then, seems supportive in demonstrating that precision teaching is an effective and efficient tool for improving learning situations with varied populations.

Precision teaching emphasizes a measurement focus towards teaching rather than a method approach; it does not give teachers a new curriculum, but a way to assess whether or not their current curriculum methods are achieving the hoped for results. This indicates to teachers the rate at which students are learning, and whether that rate is acceptable.

Concepts

Precision teaching has as a base two concepts which require some explanation. The first concept is <u>proficiency</u>. A proficient student is one who has mastered a certain amount of curriculum. How is proficiency measured? Through two methods: accuracy and fluency.

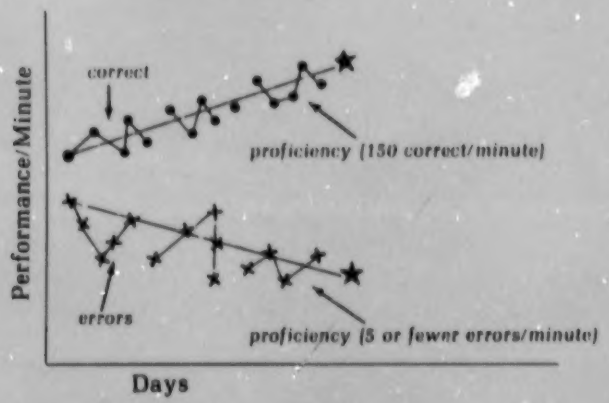
An accurrate student has a high percentage of problems correctly solved; words correctly spelled; words correctly read; or whatever the curriculum requires. Most teachers are taught that accuracy = proficiency. Yet if we compare two students who

can accurately say the alphabet, and it takes one student 10 seconds to say it and the other three minutes, the latter could hardly be described as proficient.

Thus, fluency comes into the picture as a very important part of a student's learning environment. Fluency is counting the number of movements performed by the learner over time. A movement is defined as any action which is observable; has a beginning and an ending point; and is repeatable. Writing numbers, writing letters, reciting words read; each act is defined as a movement. If students are administered a math worksheet where they are to add single column problems with sums under 20; and one student completes 30 problems during that minute while the other completes five, then we can safety say that the first student is more fluent. If both were given unlimited time to complete a set of problems, both would appear accurate; but this is misleading. The more fluent student also seems to be one who can retain material over a longer period of time and also has the greater capability to generalize and apply material once learned.

If a standard criteria for fluency and accuracy were established (that is, a criteria for proficiency) than most students, even the slowest (although possdibly on fewer skills & concepts), should be able to work towards proficiency.

Learning measurement is the second basic concept of precision teaching, and it refers to making frequent repeated measures on a curriculum slice until proficiency is obtained. Rather than measure a gross segment of learning via a standardized test on an infrequent basis, the intent is to sample student's performance for short periods during each school day. Thus a series of samples might look like the following chart where the number of correct movements is represented by the "dot", and incorrects by an "x":



In this example, it took three weeks (15 school days) to move from a level of non-proficiency to a level of proficiency. The data could represent number of words read correctly and incorrectly, problems performed, or letters recited. This represents a "learning picture" where corrects are accelerating nicely and errors are decelerating--an ideal picture.

An accurate way to chart learning performance is on the Standard Behavior Chart, developed by O. R. Lindsley, see figure 2. It represents learning more accurately in terms of proportional growth rather than standard interval growth. (For more information regarding the chart, see Teaching Exceptional Children, spring, 1971). Among the features of the Standard Behavior Chart are that it can measure movements which occur as infrequently as once every 24 hours to as often as 1,000 times per minute. In addition, data can be plotted for up to 20 weeks. Thus, a school year's worth of learning data for any subject or curriculum area can be maintained on two charts.

Combining these basic concepts of precision teaching with the standard behavior chart can provide, then, a methodology to measure numerous instructional modifications. Regardless of how carefully we plan and devise our instructional and behavior programs nothing works every time. Children are individuals. some will positively respond to our programs immediately, some will not. by continuously assessing the progress of each child, we can tell which programs need changing and which should be left intact. When a child has stopped learning or has begun to behave disruptively, various approaches are often implemented to either improve learning or reduce disruption. Some academic procedures might include: molding, demonstration, modeling, drill, practice, feedback, consequation, and curriculum slicing. Many of these procedures may be familiar with the exception of curriculum slicing. Curriculum slicing refers to giving each student a "chunk" of the curriculum on which he or she can successfully work. If, for example, a student is given a worksheet with add facts, sums to ten, and he/she reaches proficiency after the first couple of times, then it is clear he/she is ready for a bigger "chunk". Thus, the teacher can give the child add facts, sums to 20. Once the student reaches proficiency, there is no reason to make him/her labor on material which he/she knows. Remember, proficiency means accurate and fluent, and with the added advantage of retention of that material, "quick" students are not held up while the rest of the class catches up.

A "slower" student who, for example, has a great deal of difficulty becoming proficient at add facts, sums to ten, could have the curriculum "sliced" to, say, add facts, sums to five. The child then has a smaller "chunk" to deal with, and has a greater chance achieving proficiency on that part of the curriculum much more quickly. The "fast" and "slow" student will also have charts which resemble each other. The key is that students are attempting to better their previous day's performance rather than competing with each other.

Proficiency Levels

In order to determine whether or not a student has mastered a given objective, his/her performance must be compared against some standard of success or failure. There is a need to find a

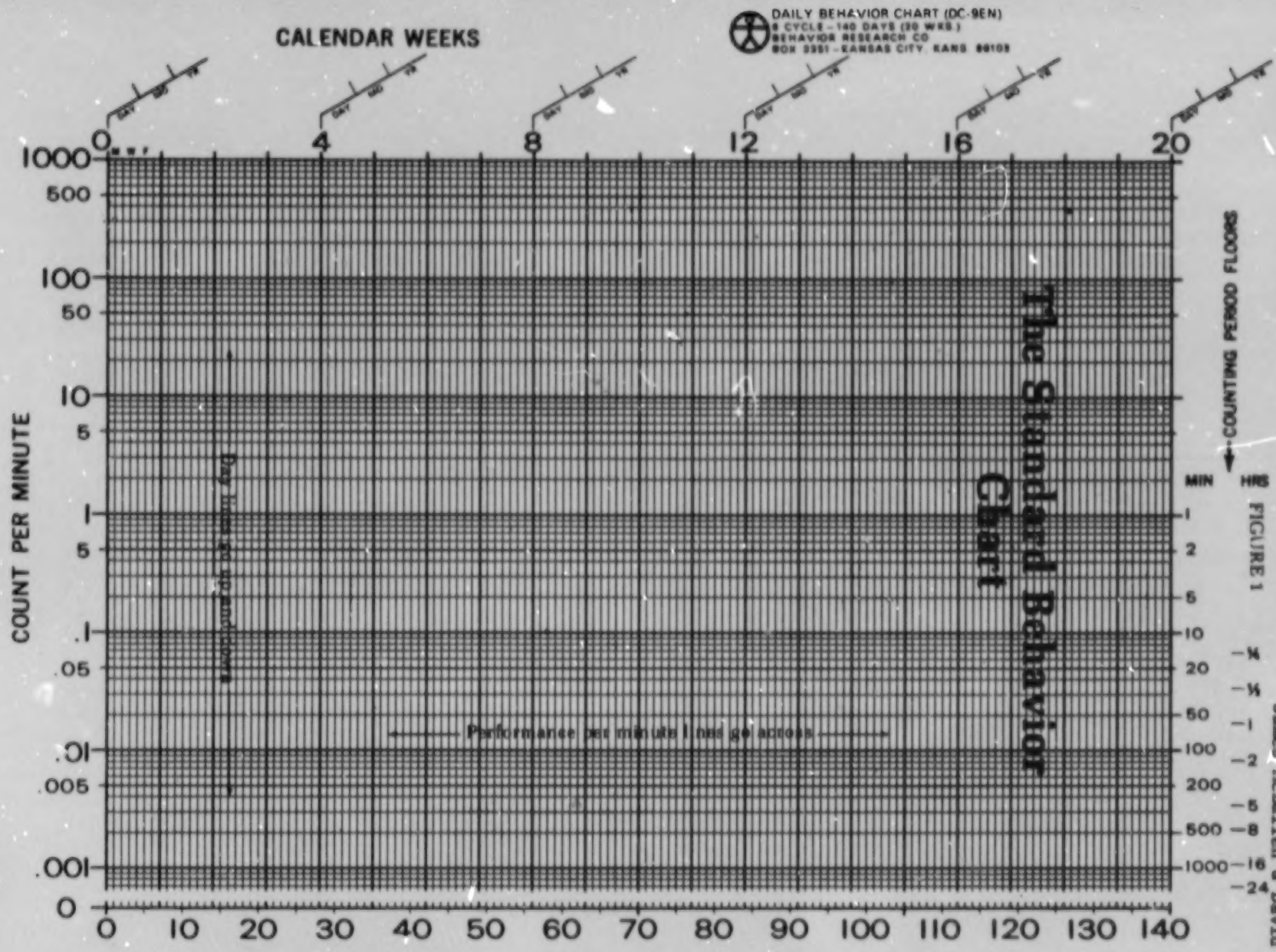


FIGURE 1

James McLallen & David Schoener

SUPERVISOR	ADVISER	MANAGER			BEHAVER	AGE	LABEL	COUNTED
DEPOSITOR	AGENCY		TIMER	COUNTER	CHARTER			

reasonable standard which can be applied to "fast" and "slow" alike. This has largely been a trial and error procedure; but standards have emerged based upon actual classroom usage of precision teaching. By using proficiency levels, a student's performance is compared to a predetermined standard. The standards are based upon the accuracy of the student's responses (correct and error statement) plus the amount of time required to make the response. Proficiency is the frequency per minute at which competency is achieved for a particular skill. Certainly, students will approach proficiency levels at different rates. Some will attain these standards quickly while others will struggle. For students who find proficiency levels difficult to attain, lower aims can be set and gradually raised until students are proficient in a given skill.

These proficiency levels have been obtained in several ways. Student data has been studied to determine what levels of performance lead to accurate and long-term maintenance of skills. Perhaps, more importantly, real world job requirements are being analyzed to determine what skill levels are necessary for vocational success. An interesting point regarding proficiency levels is that it appears that teachers and psychologists have often underestimated performance levels of their students. As a result, the levels have undergone considerable evolution over the last ten years. Useful starting points may be found through the Precision Teaching Project, Great Falls, Montana; or Project Product, Shawnee Mission, Kansas.

Learning Channels

As previously mentioned, movement cycles represent the behavioral event measured in Precision Teaching. It must be observable, repeatable, and contain movement. These cycles are measured in terms of frequency because they accurately reflect the student's performance. From an academic standpoint, the cycles would encompass both input and output channels. Input stimulation occurs through seeing, hearing, thinking, someone pointing, or touching. Output is observed through thinking, writing, saying, marking, or "doing". Thus, input/output combinations could involve any of the following:

Input	Output
See	Think
Hear	Write
Think	Say
Point	Mark
Touch	Do

In education, most input occurs from thinking, seeing, or hearing, while output occurs through writing, saying, or marking. For example, when a teacher dictates words for spelling, it is a hear (input)/write(output) exercise. A student who recites the alphabet from memory is engaged in a think(memory)/say(recitation)

exercise. Working a math sheet is a see (looking at the problems)/write(the answers) exercise. Reading aloud is see (letters)/say(words) while reading silently is a see/think exercise. Thus in precision teaching, all activities can be identified as one of the input/output channels. This becomes important when changes need to be made for a student whose learning picture seems to indicate that he is stalling out or levelling off. Often a change in the input or output channel can get the student back on the track. For example, a student who levels out on a see/write math sheet, could change output channels to a see/say exercise. Since performance is monitored daily, the effectiveness of this change becomes apparent rather quickly.

Stages of Learning

As a result of extensive work with precision teaching stages of learning seem to be emerging. Research in learning processes is at an early stage and any attempt to identify distinctly different phases in that process is speculative. However, information has been collected on enough different children (both handicapped and general education) to encourage further analysis (Haring & White, 1976). It is possible that some skills may develop through stages such as:

Acquisition: In the acquisition stage the student is learning what is required of him/her. In this stage the focus is primarily directed toward giving the student the necessary information to learn the skill. There is an emphasis on teaching strategies, materials, instructional formats. Performance is characterized by a relatively high error rate and hence feedback is necessarily provided as immediately as possible. The precision teaching process at this stage indicates to the teacher whether or not the student is acquiring the basic knowledge to move on to independent practice. If changes are to be made, they usually involve modifying the materials, formats, or instructional delivery in order to enhance communication to the student.

Fluency Building: In this stage the student has acquired the basic concept but needs the opportunities necessary to make the skills useful. He/she must be able to perform the skill quickly and easily in order to ensure retention and application. Performance in this stage is characterized by a relatively low error rate and a moderate to high correct rate. If changes are to be made, they usually consist of modifying consequation or reinforcement. It is critical to allow the student sufficient opportunity to practice the skill at this stage to perfect what he/she already basically understands.

Maintenance: After the child has acquired the skill and brought his/her performance level to proficiency, it is often helpful to provide maintenance checks to determine retention. At this stage the emphasis is on establishing competency that will last over a long period of time.

Application: In this stage the focus of measurement is reduced and the emphasis is on practical application of the established skill in various situations. Life experiences, projects, games, etc. provide the student with the opportunity to apply and generalize what he has already learned.

The precision teaching process has also developed some tentative decision rules regarding the movement from one stage of the learning process to the other. These quickly provide teachers with substantial information in matching the appropriate instructional change with the specific phase of learning the child may be in. For instance, it seems impractical to place heavy emphasis on a reinforcement system when the student may be at an acquisition level where he/she primarily needs information on how and what to perform. Teaching strategy for the most part differs with each stage, and learning becomes more efficient when applying the appropriate strategy with the corresponding stage of learning.

Practical Applications

Precision teaching and the standard behavior chart lend themselves to a multitude of uses. At a school for trainable and severely and profoundly retarded youngsters, it has been used to chart a student's spontaneous verbalizations during instructional time. These ranged from an average of 110 during a 30 minute period for the baseline period; to an average of 12 during the treatment period. A standard interval chart would need to be rather large in order to show this difference; but on the standard behavior chart, the change can be shown easily.

Precision teaching has been used by an LD teacher to assess improvement in a student's sight vocabulary. Another LD teacher used it to assess mastery of math concepts in a student. In both cases the immediate feedback on a daily basis proved to be excellent motivation for youngsters who previously had little or no motivation for learning.

Precision teaching has been employed by a regular education teacher to teach time concepts to her second grade class. This was accomplished in a relatively short amount of class time by a teacher's aide. Now all of her students can accurately tell time.

It has been used by a fifth grade teacher to teach her social studies class the names of all 50 states. Most of her students were able to write the postal abbreviations of all 50 states on a map in one minute after the average of 15 trials.

These are but a few of the ways precision teaching can be adapted to the needs of the classroom teacher, provided that teacher understands the principles involved.

Precision teaching has been implemented locally in regular education classes as large as 27, and classes for the learning disabled, emotionally disabled and mentally disabled.

Benefits

Among the benefits teachers have commented on are:

1. **Motivation for the student.** Most students respond to the proficiency aim provided them and work very hard to achieve that aim. The point here is that the students are working to improve their own records as opposed to competing with other students. Two students may have charts which appear quite similar; one, however, may be working on add facts "+5", while the other is working on subtraction facts with borrowing. Students enjoy this so much that, in one class they told a substitute teacher who knew nothing about precision teaching, that they wanted to do their timings.

2. **Time Efficiency.** Generally, it takes 15-20 minutes for a teacher to assess a regular class and its progress each day in a number of curriculum areas.

3. **Availability of practice sheets.** Precision teaching as a measurement tool requires the generation of a wide range of practice sheets. Fortunately most sheets any teacher would need are already available, and can be ordered at a reasonable cost. This removes a large drawback in that teachers do not have to make up their own sheets--another time saver.

4. **Evaluating student "learning pictures".** Daily assessments yield data points on the charts which can be connected. These lines of learning then can be evaluated as learning pictures. If a student stalls out or levels off in his progress, then the teacher has direct evidence that some change in his teaching strategy is required.

5. **Documentation.** P.L. 94-142 and state requirements for special education emphasize the need for documentation. By assessing students daily rather than once or twice a year on standardized tests, teachers have met this requirement with truly meaningful documentation.

6. **Common vocabulary and approach to learning.** On the occasions where teachers from different schools in our area have gathered to discuss precision teaching, little time is lost in establishing what one teacher means by "learning". Because ambiguities about the meaning of words like "learning", "fluency", and "accuracy" are removed, teachers are able to communicate much

more effectively. This is especially useful when a student moves from one grade to the next. The new teacher knows precisely where the student ended his year in the previous grade. Little time is lost for the new teacher in knowing where to start. The same advantage holds true when the psychologist works with the teacher on a child who is demonstrating a slow rate of learning.

7. **Teacher effectiveness.** A common benefit accruing to a precision teacher is a daily feedback regarding the efficacy of instructional decisions. Each decision regarding the child's program is clearly marked on the student chart. Subsequent assessment reveal the effectiveness of the educational decision for that particular child. As a result the precision teacher is aware in a short amount of time whether his/her teaching methods, techniques, materials, strategies, are producing the desired effect. If they are--great. If not, new ideas may be employed in a very systematic rather than haphazard fashion. This dynamic and reciprocal interchange between teacher decision and student learning represents the essence of precision teaching.

Psychological Involvement

The reader may be asking, why should psychologists become involved in precision teaching when it seems to be a tool to be used by the teacher only. The answer, it seems to us, comes from several directions.

First, as the person most qualified and highly trained in the area of measurement, the school psychologist can lend credence to this approach to learning. It only makes sense that we make our expertise available to teachers who begin to use this as a way of assessing teaching and intervention strategies.

Second, if the school psychologist knows precision teaching and the skills required to be "proficient" at it, he/she can recommend those teachers for whom it would have the greatest chance of success. It is our opinion that requiring every teacher in a building to use precision teaching through administrative edict would probably doom its use as an effective tool. The best way it can be spread is by the teacher's comments. So, one key is to try it out on one or two teachers who seem to have the energy, interest, and organizational skills needed for proper implementation. Once that is in place, it is our experience that other teachers in the building become interested because of the precision teacher's comments and the students' reactions.

Third, psychologists have numerous consultations with teachers regarding academic, social, and emotional intervention strategies. Precision teaching offers a viable technique to measure not only

the effectiveness of the strategies but also of the consultation process itself. If the end goal of any consultation interaction is to enhance student performance, then it seems viable that the consultation interaction itself should be judged by this critical variable--is the child benefiting from my involvement.

Summary

Precision teaching is a fairly recent development based upon demonstrated learning principles. It involves direct and frequent measurement of the task which is being taught by teachers.

It is not a method of teaching. It is a way to find out what teaches. It is a way in which the effects of teaching strategies and instructional situations may be evaluated. With this knowledge the teacher may determine what is effective and what is not. As a measurement system precision teaching can be applied in numerous situations. It can be used to assess the effects of educational programs, parent involvement, open classrooms, or behavior modification strategies. Any situation designed to change people should be describable in terms of the changes it is designed to produce. Precision teaching measures those situations and provides the information necessary to improve those situations (White and Liberty, 1976).

It is our hope that this chapter has spurred the interest of some readers to pursue precision teaching as a tool which will be of help not only to them, but to teachers and, ultimately, to students. A complete bibliography has been included for that purpose.

Bibliography

Alper, Theodore, G. and Krazier, G. G. "Comparison of Effectiveness of Behavioral and Client-Centered Approaches for Behavioral Problems of Elementary School Children," Elementary School Guidance and Counseling, 5, (Oct. 1970), 35-43.

Alper, Theodore, G. A Comparison of Two Treatment Approaches for the Behavioral Problems of Elementary School Children. Dissertation Abstracts International. May 1970, Volume 30 (11-A0, 4762.

Alper, T. G. and White, Owen R. "Precision Teaching: A Tool for the School Psychologist and Teacher," Journal of School Psychology, 9, (1971), 445-454.

Alper, Theodore, et. al. "The Rated Assessment of Academic Skills," Academic Therapy, 9, (Winter 1973-74) 151-164.

Bates, Douglas F. School-Wide Implementation of Precision Teaching. Unpublished Doctoral Dissertation, University of Kansas, 1971.

Bates, Stephanie and Bates, Douglas F. ". . . and a child shall lead them: Stephanie's Chart Story, "Teaching Exceptional Children, 3, (Spring 1971, 111-113.

Beck, Ray. Report for the Office of Education Joint Dissemination Review Panel, Precision Teaching Project, Great Falls, Montana, 1979.

"Behavior Modification and Precision Teaching," In G. D. Alpern and T. J. Boll, (eds.), Education and Care of Moderately and Severely Retarded Children--With a Curriculum and Activities Guide. Seattle, Washington: Special Child Publications, 1971, pgs. 73-82.

Bennett, Patricia Ann. A Comparison of Programmed and Guided-Discovery Instruction on Acquisition Rate in Mathematics. Univ. of Oregon, Experimental Education Unit, Working Paper No. 14, 1973.

Berger, Kathleen S. Adolescent Self Charting and Change. Doctoral Dissertation, Yeshiva University, 1972.

Bersoff, Donald N. and Ericson, Colleen R. "A Precise and Valid Measure of Behavior and Behavior Change in the Classroom," Journal of School Psychology, 10, (1972).

Billingsley, Felix F. and Smilser, Sandra F. "A Group Approach to Classroom Management: The Behavior Game", Teaching Exceptional Children, (Fall 1974), pgs. 30-33.

Bradfield, Robert. (Ed) Behavior Modifications of Learning Disabilities San Rafael, Calif: Academic Therapy (1971).

Bradfield, Robert N. "Precision Teaching: A Useful Technology for Special Education Teachers," Educational Technology, 10, (August 1970), 22-26.

Brammer, Karen. The Effect of Reduction of Problems Per Page in Accelerating Arithmetic Performance. Univ. of Oregon, Experimental Education Unit, Working Paper, No. 6, 1973.

Brent, George, et. al. Instructional Decisions from Precision Teaching. Glassboro State College, Teacher Corps Project, Working Paper No. 1, 1976.

Brent, George Precision Teaching a Tool for Learning. Fair Lawn, NJ: JAB Press, 1976, (Cassette)

Brent, George. "Putting Classroom Teaching into Focus," Introspect, 1, (December 1975), 5.

Busse, Larry L. and McElroy, Arthur A. "The Blind Can Chart" Teaching Exceptional Children, (Summer 1975), pgs. 116-117.

Caldwell, Thomas E. Can Pupil Performance Rates Tell Us When a Student Teacher is Ready for Her Own Class? Unpublished Doctoral Dissertation, Univ. of Kansas, 1967.

Caldwell, Thomas E. "Teacher Training Tools for Precision," in June B. Jordan and Lynn S. Robbins., (eds.), Let's Try Doing Something Else Kind of Thing, Behavior Principles and the Exceptional Child, Arlington, Va.: Council for Exceptional Children, 1972, pgs. 110-117.

Caldwell, Thomas E. and Taylor, James R. Principles of Precision Teaching, Paper presented at a workshop of the Greater Hospital Planning Council of the Greater Miami Valley Workshop, Dayton, Ohio, October 1968, and the Indiana Asociation for Retarded Children Annual Convention, Ft. Wayne, Indiana, April 1969.

Carson, Ralph and Houghton, Eric, Precision Teaching, Lindsley's IS-Does. Unpublished manuscript, University of Oregon, 1968.

Clover Park Public School District #400, Progress Report, Computerized Performance (of) Adapted Resources in Education for Handicapped Children (Compare). Unpublished report, William Kalenious, Project Director, Lakewood, Washington, 1973.

Cohen, Marilyn A. and Martin, Grant L. "Applying Precision Teaching to Academic Assessment." Teaching Exceptional Children, 3, (Spring 1971), 147-150.

Cohen, Marilyn A.; Gentry, N.E.; Hulten, W. J.; and Martin, Grant L. "Measures of Classroom Performance," in Haring and Hayden, (eds.), The Improvement of Instruction, Seattle, Washington: Special Child Publications, 1972.

Diedrich, W. M. "Procedures for Counting and Charting a Target Phoneme," Language, Speech, and Hearing Services in Schools, 5, (1971).

Diedrich, W. M. Training Speech Clinicians in the Recording and Analysis of Articulatory Behavior. Year 11 Summary Report 1971, Special Project, U. S. Office of Education, Grant No. OEG 261293-3402 (031).

Dixon, Michael H. Appropriate and Inappropriate Classroom Behavior Rates of Individual Children. Unpublished Masters Thesis, Univ. of Kansas, 1969.

Duncan, A.D.; Hively, W.; & Spence, I. Precise Personal Management and Precision Teaching: A Handbook for Human Behaviorists. in press.

Duncan, Ann Dell Warren, Behavior Rates of Gifted & Regular Elementary School Children. Unpublished Doctoral Dissertation, Univ. of Kansas, 1968.

Duncan, Ann Dell. The Gifted Count and Chart, in June B. Jordan and Lynn S. Robbins, (eds.), Let's Try Doing Something Else Kind of Thing: Behavior Principles and the Exceptional Child, Arlington, Va.: council for Exceptional Children, 1972, pgs. 51-55.

Duncan, Ann D. "Precision Teaching in Perspective: An Interview with Odgen R. Lindsley," Teaching Exceptional Children, 3, (Spring 1971), pgs. 144-219.

Duncan, Ann D. "Self-Application of Behavior Modification Techniques by Teenagers," Adolescence, 16, (1969), 541-556.

Duncan, Ann D. "Tracking Behavioral Growth: Day-to-Day Measures of Frequency Over Domains of Performance: Participatory Evaluation," Educational Technology, 14, (June 1974), 54-59.

Duncan, Ann D. "The View from the Inner Eye: Personal Management of Inner and Outer Behaviors," Teaching Exceptional Children, 3, (Spring 1971), 152-156.

Eaton, M., and Lovitt, T. "Achievement Test vs. Direct and Daily Measurement," in Geo. Semb. (ed), Behavior Analysis and Education - 1972. Lawrence: University of Kansas Press, 1972.

Eaton, Marie and Haisch, Luella. A Comparison of the Effects of New vs. Error Word Drill on Reading Performance. Univ. of Oregon, Experimental Education Unit, Working Paper No. 23, 1974.

Eaton, Marie and O'Connell, Sheila, The Improvement of Performance on Daily Math Assignments through a Free Choice Contingency. Univ. of Oregon, Experimental Education Unit, Working Paper No. 1, 1973.

Eaton, Marie and Feldman, Ann. The Influence of Self-Directed and Teacher-Directed Flashcard Drill on performance in Basic Add Facts. Univ. of Oregon, Experimental Education Unit, Working Paper No. 13, 1973.

Edwards, Joseph S. Precisely Teaching Children Labeled Learning Disabled. Unpublished Doctoral Dissertation, Univ. of Kansas 1969.

Ericson, Colleen Ryan. The Effects of Telecoaching on the Performance Rates of Six Hard-of-Hearing Pupils. Unpublished Masters Thesis, University of Kansas, 1968.

Fink, Elaine Rae. Performance & Selection Rates of Emotionally Disturbed & Mentally Retarded Pre-Schoolers on Montessori Materials, Unpublished Masters Thesis, Univ. of Kansas, 1968.

Freschi, David F. "Where are We. Where are We Going, How We're Getting There," Teaching Exceptional Children, (Winter 1974) pgs. 89-96.

Faqua, Wayne. "Research Problems and Tactics in a Complex Instructional System," in Fraley and Vargas (eds.) Behavior Research and Technology in Higher Education. Gainesville, Fla.: Department of Psychology, Univ. of Florida, 1976.

Gaasholt, Marie. "Precision Techniques in the Management of Teacher and Child Behaviors," Exceptional Children, 37 (October 1970) 129-135.

Galloway, Charles and Galloway, Kay C. "Parent Classes in Precise Behavior Management," Teaching Exceptional Children, 3 (Spring 1971), 120-128.

Galloway, Charles and Galloway, Kay C. "Parent Groups with a Focus on Precise Behavior Management," IMRID papers and Reports, 17 (1970).

Galloway, Charles. "Precision Parents and the Development of Retarded Behavior," in June B. Jordan and Lynn S. Robbins (eds.) Let's Try Doing Something Else Kind of Thing, Behavior Principles and the Exceptional Child, Arlington, Va.: Council for Exceptional Children, 1972, pgs. 92-109.

Genardi, Dick Anthony. A Study on the Predictive Validity of a Median-Based, Trend-Descriptive Linear Function. Unpublished Doctoral Dissertation, Univ. of Oregon, 1974.

Gerfield Elementary School Staff. Project Turn-About. Unpublished Explanatory Manual: Training Program for Teachers through Western Washington State College, Everett, Wa., 1972.

Glenn, Linda L. A Proposed System of Instruction, Cost Accountability, and Teacher Evaluation by Building Principals. Unpublished manuscript, November, 1972.

Great Falls Public Schools. Progress Report 1-1973-74, Educational Remediation for Children with Learning Deficits through Precision Teaching. Unpublished Report, Ray Beck, Project Director, Great Falls, Montana, 1974.

"Graphs that Look Funny but Tell You a Lot." Changing Times, The Kiplinger Magazine, 24, (November, 1970), 34-37.

Hanby, Virdie L. A Comparison of 1974 Scores with 1911-1913 Scores on the Courtis Standard Tests. Unpublished Paper, S.S.T. Learning Disabilities Project, Tacoma Public Schools, Tacoma, Washington, 1974.

Hanby, Virdie L. Measuring Oral Language Performance of Preschool Children, Unpublished Paper, S.S.T. Learning Disabilities Project, Tacoma Public Schools, Tacoma, Washington, 1974.

Haring, Norris G. and Gentry, N. Dale. "Direct and Individualized Instructional Procedure," in Haring and Schiefelbusch (eds.) Teaching Special Children. New York: McGraw-Hill, 1976.

Haring, Norris. Investigation of Systematic Instruction Procedures to Facilitate Academic Achievement in Mentally Retarded Disadvantaged Children. Final Report. Bureau for the Education of the Handicapped, Washington, D.C., Grant No. OEG 0-9-572167-4270 (032).

Haring, Norris G. "The Systematic Use of Contingencies in Classes for Children with Academic and Social Response Deficits," Education Technology, 11 (April 1971). 54-58.

Haughton, Eric C. "Aims-Growing and Sharing," in June B. Jordan and Lynn S. Robbins, (eds.), Let's Try Doing Something Else Kind of Thing. Behavior Principles and the Exceptional Child, Arlington, Va.: Council for Exceptional Children, 1972 pgs. 20-39.

Haughton, Eric. "Correlation of Say Sounds to Say Words." Behaviorgrams, January 21, 1971. Article 061.

Haughton, Eric C. "Counting Together: Precision Teaching Rationale 69." Paper submitted to Dr. Robert Bradfield, Book of Readings, Univ. of Oregon, Eugene, Oregon, 1969.

Haughton, Eric C. "Curriculum Options -- Take Your Class to An Airport: Learn Symbols," Special Education in Canada, 48 (1974), 12-17.

Haughton, Eric C. "Define Your Act and Set Your Fluency Goals in Personal, Social and Academic Areas," Special Education in Canada, 48 (1974), 10-11.

Heckler, Jay D. "Systems Within the Personalized Learning Center," in Higher Education. Gainesville, Fla.: Dept. of Psychology, Univ. of Florida, 1976.

Hirsch, Judy. "Let Your Students Chart Your Behavior," Teaching Exceptional Children, 3, (Spring 1971), 135-136.

Hoeltzel, Rodney C. Reading Rates and Comprehension as Affected by Single & Multiple-Ratio Schedules of Reinforcement Within a Token Economy as Measured by Precision Teaching Techniques. Unpublished Doctoral Dissertation, Univ. of Southern California 1973.

Hofmeister, Alan. "Educational Trends and Special Education," Slow Learning Child: The Australian Journal on the Education of Backward Children, 16 (1969), 67-72.

Holdrinet, Daniel. "Precision Teaching: Un enseignement indiidulise en class," Special Education in Canada, 48, (1973), 7-8, 10-12.

Homme, L. "Using Behavioral Technology to Alter Children's Behavior," in P. A. Gallagher and L. L. Edwards, (eds.), Educating the Emotionally Disturbed: Theory into Practice. Proceedings of a symposium, Topeka, Kansas, 1970.

Issacs, Morton. "Precision Teaching of the Deaf," American Annals of the Deaf, 118, (December 1973), 686-690.

Johnson, Evelyn C. "Precision Teaching Helps Children Learn," Teaching Exceptional Children, 3, (Spring 1971), 106-110.

Johnson, D. LaMont and Brothen, Cathleen. "Precision Teaching in Your Classroom," Academic Therapy, 10, (Spring 1975), 321-316.

Johnson, Nancy J. Ann. Acceleration of Inner-City Elementary School Pupils' Reading Performance. Unpublished Doctoral Dissertation Univ. of Kansas, 1971.

Johnson, Nancy, "Precision Teaching Cuts Across Cultural Lines in June B. Jordan and Lynn S. Robbins, (eds.). Let's Try Doing Something Else Kind of Thing: Behavior Principles and the Exceptional Child, Arlington, Va.: Council for Exceptional Children, 1972, pgs. 84-91.

Johnston, James M. and Pennypacker. "A Behavioral Approach to College Teaching," American Psychologist, 26 (March 1971), 219-244.

Jordan, June B. and Robbins, Lynn S. (eds.) Let's Try Doing Something Else Kind of Thing: Behavior Principles and the Exceptional Child, Arlington, Va.: Council for Exceptional Children, 1972.

Knowles, Brian A. The Use of Precise Behavior Management Techniques in an Elementary School. Unpublished Doctoral Dissertation, Utah State Univ., 1971.

Koenig, Carl H. "The Behavior Bank: A System for Sharing Precise Information," Teaching Exceptional Children, 3, (Spring 1971), 157.

Koenig, Carl H. "Celeration Bank Instructions," Behavior Research Company, Box 355, Kansas City, Kansas 66103.

Koenig, Carl H. Charting the Future Course of Behavior. Kansas City, Kansas: Precision Media, Box 3222, 66103.

Koenig, Carl H. Precision Teaching with Emotionally Disturbed Pupils. Unpublished Honors Masters Thesis, Univ. of Kansas, 1967.

Koenig, Carl H. "The Ups and Downs of Stable Baselines," Special Education Research, Kansas City, Ka.: Univ. of Kansas Medical Center, 1969.

Korn, Max. "The Integration of Handicapped Children with Non-Handicapped Children in a Municipal Day Care Centre," Deficience Mentale/Mental Retardation, 24 (July 1974), 26-30.

Kunzelmann, H. P. "Dimensions of Precision Teaching," Sun Mountain Special Education Leadership Conference, Department of Public Instruction, State of Washington, Olympia, Wash., 1969.

Kunzelmann, Harold P. "For Successful Program Maintenance: Look at the Data First." in June B. Jordan and Lynn S. Robbins, (eds.) Let's Try Doing Something Else Kind of Thing: Behavior Principles and the Exceptional Child. Arlington, Va.: Council for Exceptional Children, 1972, pgs. 118-126.

Kunzelmann, Harold P., M. Cohen, W. Hulten, G. Martin & A. Mingo. Precision Teaching: An Initial Training Sequence. Seattle: Special Child Publications, 1970.

Kyrklund, Sarah Jane. A Year of School-Wide Precision Teaching with Mentally Retarded Students at Johnny Appleseed School. Unpublished Honors Masters Thesis, Univ. of Kansas, 1971.

Lawrence, Teresa M. (ed.) Teaching Exceptional Children, (Spring 1971).

Liberty, Kathleen A. Data Decision Rules. Univ. of Oregon, Regional Resource Center for Handicapped Children, Working Paper No. 20, 1971.

Liberty, Kathleen A. The Non-Effect of Practice on the Rentention of Spelling Words Learned to Criterion. Univ. of Oregon, Experimental Education Unit, Working Paper No. 28, 1974.

Linde, T. F., and Kopp, T. Training Retarded Babies and Pre-Schoolers. Springfield, Illinois: Charles C. Thomas, 1973.

Lindsley, Odgen R. "Consultants Comments." in Classroom Incident Feature, NEA Journal, 55, (1966).

Lindsley, Odgen R. "Direct Measurement and Prothesis of Retarded Behavior," Journal of Education, 147 (1964), 62-81.

Lindsley, Odgen R. "An Experiment with parents Handling Behavior at Home, Johnstone Bulletin, 9, (1966).

Lindsley, Odgen R. "From Skinner to Precision Teaching" The Child Knows Best." in June B. Jordan and Lynn S. Robbins, (eds.) Let's Try Doing Something Else Kind of Thing: Behavior Principles and the Exceptional Child. Arlington, Va.: Council for Exceptional Children, 1972.

Lindsley, Ogden R. "How to Count." in C. China, A. S. Gross, J. Milby, and L. Peterson, (eds.), Proceedings of Third Annual Behavior Modification Institute. Tuscaloosa, Alabama, 1970, pgs. 121-130.

Lindsley, Odgen R. Operant Behavior Management: Background and Procedures. Brecksville Ohio Institute, 1968.

Lindsley, Ogden R. "Procedures in Common Described by a Common Language," in C. Neuringer and J. L. Michaels, (eds.) Behavior Modification in Clinical Psychology. New York: Appleton-Century-Crofts, 1970.

Lindsley, Ogden R. "Protege to Behavor," Behaviorgrams, I, (1970), 39.

Lindsley, Ogden R. "A Reliable Wrist Counter for Recording Behavior Rates," Journal of Applied Behavior Analysis, 1, (1968), 77-78.

Lindsley, Ogden R. Singing A Little Data Song. Brecksville Ohio Institute, 1967.

Lindsley, Odgen R. "Theoretical Basis of Behavior Modification. Professionalism Versus Field Commitment in Psychology and Education," in Wesley Becker, (ed.), An Empirical Basis for Change in Education. Champaign, Ill.: Research Press, 1970.

Lindlsey, Ogden R. "Training Parents and Teachers to Precisely Manage Children's Behavior," in Special Education Colloquim. Flint, Michigan: C. S. Mott Foundation, 1968.

Lovitt, Thomas C. "Applified Behavior Analysis Techniques and Curriculum Research: Implications for Instruction," in Haring and Schiefelbusch (eds.), Teaching Special Children, New York: McGraw Hill, 1976.

Lovitt, Thomas. "Behavior Modification: The Current Scene," Exceptional Children, 37, (October 1970), 85-91.

Maggs, Alex. "Precision Teaching: A Behavioral Model for Cognitive Development," Australian Journal of Mental Retardation, 2, (June 1973).

Matlos, B. "A Manual Counter for Recording Multiple Behavior," Journal of Applied Behavior Analysis, 1, (Summer 1968), 130.

McConnell, Leola. "And These Things Write We Unto You that Your Joy May be Full: A Letter," Teaching Exceptional Children, 3, (Spring 1971), 158.

McDonald, Michael G. "Counting Ideas," Teaching Exceptional Children, 3, (Spring 1971), 134.

McDonald, Phyllis, "Cross Currents: Media Offer New Sharing Possibilities," Teaching Exceptional Children, 3, (Spring 1971), 151.

McGee, John J. Free the People: An Action Guide for Managers and Consumers of Human Service Systems. Unpublished Doctoral Dissertation, Univ. of Kansas, 1975.

Mefford, John Paul. The Efficiency of a Precision Teaching Approach with Trainable Mentally Retarded Children. Unpublished Doctoral Dissertation, Indiana Univ., 1972.

Milbury, Allen W. What is the Effect of a Precision Teaching Program on the Behavior of an Adult Trainable Mental Retardate? unpublished Doctoral Dissertation, Indiana Univ., 1969.

Monner, Rochelle V. and Hanley, Virdie L. A Comparison of 10 Daily One Minute Timings with 10 Fifteen Second Timings Administered on One Day, Unpublished Document, S.S.T. Learning Disabilities Project, Tacoma, Washington.

Morrey, J. G. Parent Training in Precise Behavior Management with Mentally Retarded Children. Unpublished Doctoral Dissertation, Utah State Univ., 1970.

Mowrer, D. D. "Evaluating Speech Therapy through Precision Recording," Journal of Speech and Hearing Disabilities, 34, (1969), 23-244.

Neely, Malcolm D. Measurement and Research within the Classroom by the Use of Celeration and Final Celeration Frequencies. Unpublished Monograph, Thurston County Cooperative Spcial Services, Olympia Public School District III, Olympia, Washington, 1974.

Pennypacker, H. S., Koenig, C. H., & Lindsley, O. R. Handbook of the Standard Behavior Chart (Preliminary Ed.) Kansas City, Kansas: Precision Media, Box 3222, 66103, 1972.

Pennypacker, H. S. "Measurement, Accountability and the Economics of a Complex Instructional System," in Fraley and Vargas (eds.) Behavior Research and Technology in Higher Education. Gainesville, Fla.: Dept. of Psychology, Univ. of Florida, 1976.

Pennypacker, H. S., and Ellis, Jonnie, "Precision Teaching: An Alternative to the Information Gap." People Watching, 1, (1972), 90-96.

Pennypacker, H. S. "The Role of Direct Measurement in the Evolution of a Complex Educational System," in Fraley and Vargas (eds.) Behavior Research and Technology in Higher Education. Gainesville, Fla.: Dept. of Psychology, Univ. of Florida, 1976.

Pennypacker, Susanne F. "Internal and External Systems of the Personalized Learning Center," in fraley and Vargas (eds.) Behavior Research and Technology in Higher Education. Gainesville, Fla.: Dept. of Psychology, Univ. of Fla. 1976.

Perine, Marjorie M. "Descreasing Talkouts," Teaching Exceptional Children, 3, (Spring 1971), 133-134.

Perry, B. Fisher. "The Liberation of Johnny, " Teaching Exceptional Children, (Spring 1974), pgs. 154-161.

Precision Teaching Training Manual, Precision Teaching Project, Great Falls, Montana.

Ramp, Eugene A., and Hopkins, Bill I. A New Direction for Education: Behavior Analysis, Vol. 1, Lawrence: Univ. of Kansas, 1971.

Rickert, Devoe D., and Morrey, James G. Parent Training in Precise Behavior Management with Mentally Retarded Children. Final Report. Bureau for the Education of the Handicapped. Washington, D.C. Grant No. OEG 8-9-542135-2023 (032).

Schiefelbusch, Richard L. and Haring, Norris. "Perspectives on Teaching Special Children," in Haring and Schiefelbusch (eds.), Teaching Special Children. New York: McGraw-Hill, 1976.

Schmid, Calvin F. Handbook of Graphic Presentation. New York: Ronald Press Co., 1954. (See Chapter 5 on Semilogarithmic or Ratio Charts.)

Skinner, B. F. Contingencies of Reinforcement: A Theoretical Analysis. New York: Appleton-Century-Crofts, 1969.

Skinner, B. F. The Technology of Teaching. New York: Appleton-Century-Crofts, 1968.

Slezak, Sally A. Two Years of Precisely Teaching Orthopedically Handicapped Pupils. Unpublished Honors Masters Thesis, Univ. of Kansas, 1969.

Smith, Vincent D. A Comparison of Student Teacher Evaluation Procedures with Direct Measures of Pupil Performance. Unpublished Doctoral Dissertation, Univ. of Oregon, 1974.

Sokolove, Haryette E. Inner Behavior: The Private I Becomes Public Information. Kansas City, Kansas: Precision Media, Box 3222, 66103, 1973.

Sourisseau, Nick (trans.) "Precision Teaching: Individual Programmes in Group Settings," Special Education in Canada, 48 (1973) 9.

Spokane Public Schools. Frequency of Occurrence of Lower and Upper Case Letters in the First and Second Pre-Primers of Ginn and Scott Foresman, Evelyn Rice, Administrator, S.S.T. Learning Disabilities Project, Spokane, Wash., 1974.

Spokane Public Schools. Is Say Words Frequency Related to Comprehension? Unpublished Document, S.S.T. Learning Disabilities Project, Spokane, Wash., 1974.

Starlin, Ann. "Charting Group and Individual Instruction," Teaching Exceptional Children, 3, (Spring 1971), 135-316.

Starlin, Ann. "Sharing a Message About Curriculum with My Teacher Friends," in June B. Jordan and Lynn S. Robbins, (eds.) Let's Try Doing Something Else Kind of Thing: Behavior Principles and the Exceptional Child, Arlington, Va.: Council for Exceptional Children, 1972.

Starlin, Clay. "Evaluating Progress Towards Reading Proficiency," in B. Bateman, (Ed.), Learning Disorders, Vol. IV, Seattle, Wash.: Special Child Publications, 1971.

Starlin, Clay. "The Need for a Standard and More Precise Means of Educational Measurement," in J. Morrey, (ed.), Learning and Behavior Management in Teacher Training. Pocatello, Idaho: Idaho State Univ., 1971.

Starlin, Clay. "Peers and Precision," Teaching Exceptional Children, 3, (Spring 1971), 129-132.

Stiles, Richard L. & Martin, Grant L. Step-Wise Multiple Regressions Studies of Basic Movement Cycle Data with Norm Referenced Achievement & Aptitude Batteries from Selected Elementary Pupils, Unpublished Paper, Tacoma Public Schools, Tacoma, Washington, 1973.

Stiles, Richard L. Step-Wise Multiple Regression Study of S.S.T. Basic Movement Cycle Data With SFTAA/CTBS Results from 348 Third Grade Pupils, Unpublished Document, Tacoma Public Schools, Tacoma, Washington, 1973.

Stromberg, Gene. "Curriculum Options-Pizze may Fill but Nutrients Feed." Special Education in Canada, 48 (1974) 12-18.

Stromberg, Gene. "Pinpointing - Helps Teens End Self-Destructive Feelings," Special Education in Canada, 48, (1974), 19.

Tacoma Public Schools, Instructor's Manual Classroom Management for Continuous Progress Systems Using S.S.T. Remediation Materials. Unpublished Document, Tacoma School District #10, Pupil Personnel Services, Tacoma, Washington.

Tacoma Public Schools. Providing Educational/Vocational Opportunities. A Precision Measurement Based Educational Unit. Unpublished Document, Tacoma School District, Tacoma, Washington.

Taylor, J. R. "An Introduction to Precision Teaching with the Handicapped." Slow Learning Child, 17 (1970) 97-106.

Taylor, James R. Precision Teaching Manual. Unpublished manuscript, Johnny Appleseed Centre, Ft. Wayne, Indiana, August, 1969.

Tetley, Pamela Ann. Continuous Description, Measurement and Modification of Teacher & TMR Pupil Behaviors Through the Use of Precision Teaching & Interaction Analysis. Unpublished Doctoral Dissertation, Indiana Univ., 1971.

Thurston County Cooperative Special Services. Celeration Bank Directions and Dictionary - 7301. Unpublished Document, Olympia School District #111, Olympia, Wash., 1973.

Thurston County Cooperative Special Services. Management and Accountability in the Classroom - 7500-01. Unpublished Directions and Dictionary, Stillman W. Wood, Project Director, Olympia School District #111, Olympia, Washington, 1973.

Tomaras, Sophronia N. Curriculum Materials for Individualized Instruction: How to Create Rate Sheets. Unpublished Paper, S.S.T. Learning Disabilities Project, Tacoma Public Schools, Tacoma, Wash., 1974.

Tomaras, Sophronia N. Multiple Consecutive Timings: A Remediation Tactic. Unpublished Document, S.S.T. Learning Disabilities Project, Tacoma Public Schools, Tacoma, Wash., 1974.

Tomaras, Sophronia N. Timed Math in the First Grade. Unpublished Paper, S.S.T. Learning Disabilities Project, Tacoma Public Schools, Tacoma, Wash., 1974.

Tomaras, Sophronia N. Trace to Write Numbers in the First Grade. Unpublished Paper, S.S. T. Learning Disabilities Project, Tacoma Public Schools, Tacoma, Wash., 1974.

Unique Curriculums - Curriculum Ladders in Mathematics, Reading, and Spelling. Route 2, Box 311, Bemidji, MN.

Washington State Superintendent of Public Instruction. Progress Report II, Child Service Demonstration Programs in Seattle Spokane - Tacoma for precise Educational Remediation for Managers of Specific Learning Disabilities Programs. Unpublished Document, Harold P. Kunzelmann, Project Director, Olympia, Wash., 1972.

Washington State Superintendent of Public Instruction, Progress Report III, Child Service Demonstration Programs in Seattle - Spokane - Tacoma for Precise Educational Remediation for Managers of Specific Learning Disabilities Programs. Unpublished Document, Harold P. Kunzelmann, Project Director, Olympia, Wash., 1973.

Washington State Superintendent of Public Instruction, Progress Report IV, Child Service Demonstration Programs in Seattle - Spokane - Tacoma for Precise Educational Remediation for Managers of Specific Learning Disabilities Programs, Unpublished Document, Beth Willis, Project Director, Olympia, Wash., 1974.

Waters, K., and Galloway, C. Chart with Heart, or A Supplementary Guide to Precision Teaching, Planning, and Charting Techniques. Omaha, Nebraska: ENCOR, 1972.

Weisfeld, Sandra. "Precision Teaching in Church Basement," Special Education in Canada; 48, (Summer 1974).

Weld, Walter E. How to Chart. Norwood, Mass.: Codex Book Co. Inc.

Went, Honey, and Coulson, Grant. "Former Drug-Abusers Gain Year in Weeks through Precision Teaching," Special Education in Canada, 48 (1974), 20-23.

White, Owen R. and Liberty, Kathleen A. "Behavioral Assessment and Precise Educational Measurement," in Schiefelbusch and Haring (eds.). Teaching Special Children, New York: McGraw-Hill, 1976.

White, Owen R. Glossary of Behavioral Terminology. Champaign, Ill.: Research Press Co., 1971.

White, Owen R. A Manual for the Calculation and Use of a Median Slope - A Method for Progress Estimation and Prediction in the Single Case. Univ. of Oregon, Regional Resource Center for Handicapped Children Working Paper No. 16, 1972.

White, Owen R. A Pragmatic Approach to the Description of Progress in the Single Case. Unpublished Doctoral Dissertation, Univ. of Oregon, 1971.

White, Owen R. The Prediction of Human Performances in the Single Case: An Examination of Four Techniques. Univ. of Oregon, Regional Resource Center for Handicapped Children, Working Paper No. 15, 1972.

White, Owen R. Some Additional Considerations in the Use of a Precision Teaching Approach for a Broad Based Data Management System. Unpublished Paper, Experimental Education UNIT CDMRC, Univ. of Washington, Seattle, Wash., 1974.

White, Owen R. The "Split-Middle." A "Quickie" Method of Trend Estimation. Univ. of Oregon, Regional Resource Center for Handicapped Children, Working Paper No. 2, 1971.

White, Owen R. Taking Progress into Account: The Use of the Median Slope Procedures in the Analysis of Single-Subject Time-Series Data. A paper presented at the Second Annual Washington Educational Research Association, Seattle, Wash., 1974.

Yellowlees, Jackie. "Math Practice Root of Self-Confidence," Special Education in Canada, 43, (Summer 1974).

Young, Bonnie J. "Imagine You're the Parent of a Deaf-Blind Child," in June B. Jordan and Lynn S. Robbins, (eds.), Let's Try Doing Something Else Kind of Thing: Behavior Principles and the Exceptional Child, Arlington, Va.: Council for Exceptional Children, 1972.

Young, James R. Precision Teaching 1: A Course in Basic Procedures. Provo, Utah: Brigham Young Univ. Publications, 1972.

Zimmerman, Charles D. Classroom Academic Feedback & Elementary Administration & Staff Behavior. Unpublished Doctoral Dissertation, Univ. of Oregon, 1969.

Zimmerman, Joseph, Zimmerman, Elaine, et. al. "Doing Your Own Thing with precision: The Essence of Behavior Management in the Classrooms," Educational Technology, 7, (April 1971), 26-32.

Differential Reinforcement Of Other Behavior

by

George G. Bear
Heartland Area Education Agency

Introduction

When presented with the task of reducing excessive behavior, techniques discussed elsewhere in this book may first come to mind, e.g., punishment, time-out, extinction, and overcorrection. Typically, positive reinforcement is not seriously considered as a viable option, since it is commonly associated only with other increasing and not decreasing the rate of a targeted response. It is clear however that positive reinforcement, when combined with other procedures, can increase desired behaviors while at the same time reduce inappropriate behaviors.

The present chapter reviews the use of such a behavior modification technique: differential reinforcement of other behavior (DRO). DRO combines two principles of controlling unwanted behavior: positive reinforcement and extinction. Although various definitions and usages of the term have been proposed, DRO can perhaps most simply be described as the reinforcement of all other behaviors of an organism not specifically defined as the targeted undesirable behavior.

Differential reinforcement of other behavior is not a new technique to the schools. As will be shown later in this chapter, DRO schedules are responsible for maintaining many of the behaviors which occur in the natural environment. However, it has only been in recent years that researchers have systematically studied the use of DRO in applied settings. Based on their findings, it is evident that DRO is an effective technique that can easily be used by school psychologists to decrease certain undesirable behaviors in school and home settings while accelerating the acquisition of higher response rates of appropriate behavior. The purposes of this chaper are threefold: a) to provide school psychologists with a basic theoretical understanding of the principles that underlie DRO, b) to review those studies that have employed DRO with school-aged and preschool children, and c) to delineate procedures and steps necessary for the successful implementation of the DRO technique. As with other behavioral techniques, there are advantages and limitations inherent in the DRO procedure. These advantages and disadvantages will be addressed throughout the chapter.

Underlying Principles of DRO

In behavioral terminology, a group of responses that share one or more characteristics constitutes what is referred to as a "response class." A basic principle of behaviorism is that

whenever one member of a response class is reinforced while other members are ignored, the reinforced response increases in rate while the other responses decrease. When this occurs, the reinforced response becomes "differentiated" from the other members of the response class. No longer do the responses in the same class occur at the same rate. The "differentiated response" is developed as a result of the increase in reinforcement it receives. The other members of the response class decrease in rate due to extinction, i.e., the removal of the availability of reinforcement for those responses. This procedure of reinforcing one response and excluding the others is called "differential reinforcement." As implied in the term DRO, differential reinforcement is critical to the DRO procedure.

Differential reinforcement can account for the development and maintenance of many behaviors. Ideally, students are reinforced in the classroom when they exhibit appropriate behavior, and ignored (extinction occurs) when their responses are inappropriate. For example, the following behaviors are similar in their topography and comprise a response class: talking-out, raising your hand, talking and raising your hand at the same time, raising your hand and shouting, standing up and raising your hand, etc. If a teacher calls on the student only when her/his hand is raised and the other behaviors are not displayed, the teacher will increase the rate of appropriate hand raising with positive reinforcement and decrease the rate of the other responses in the response class by removing the reinforcement of other responses (assuming that attention from the teacher was the reinforcing stimulus). As such, the teacher uses differential reinforcement. Likewise, many school principals and administrators use differential reinforcement with school psychologists -- they increase the rate of one response in the school psychologist's repertoire (or response class) by reinforcing what they consider to be appropriate school psychologist behavior (testing?), while ignoring other skills the psychologist may have.

In a sense, shaping and differential reinforcement are similar. Shaping, the process through which new responses are developed, involves differential reinforcement. In shaping, specific responses are selectively (i.e., differentially) reinforced in a sequence of successive approximations to the terminal behavior while other responses are excluded from reinforcement (extinction). In such a manner, a new terminal behavior is achieved. Within the shaping procedure, differential reinforcement is contingently used in order to condition responses which approximate the terminal behavior. The goal of using differential reinforcement, however, is not always to develop new behaviors through the method of successive approximations, or shaping, but the purpose may be to strengthen only one already existing behavior, and not a series of successive behaviors. Thus, the two principles differ in that the goal of differential

reinforcement when used alone is not to produce new behaviors, as is the objective of shaping, but the goal is to increase the rate of a behavior that is presently found in the organism's repertoire.

Although DRO is commonly referred to as a "schedule" of reinforcement, it differs from other schedules (e.g., fixed-ratio, variable interval, etc.) in an important way. Whereas other schedules of reinforcement specify exactly what response the child must exhibit before being reinforced, DRO does not. Instead it specifies the behaviors that must not precede the delivery of the reinforcer. Within the DRO paradigm, other time-dependent schedules are used to specify more exactly when these "other" behaviors are to be reinforced. Generally, two temporal parameters within the DRO paradigm can be distinguished, continuous and interval.

Using a continuous reinforcement schedule, the experimenter delivers a reinforcer every time the subject displays a behavior other than the undesirable one. With an interval schedule, reinforcers are delivered on a fixed or variable basis contingent upon the absence of the undesirable behavior during the given interval of time. In both schedules, the occurrence of undesirable behavior postpones the availability of reinforcement. Regarding the length of the initial interval, studies have found that small initial intervals are more effective than larger ones (Martinez, 1977; Repp & Slack, 1977). Larger intervals can be used to maintain the appropriate behavior after the undesirable behavior is significantly reduced.

For example, to decrease Mary's self-stimulation, one may initially reinforce her continuously or at a short fixed interval schedule, e.g., FDRO 1' (reinforcing her each time one minute elapses without self-stimulation), and later shift to longer intervals (e.g., FDRO 3' or VDRO 3') to maintain the reduced rate of self-stimulation. The higher the rate of self-stimulation, the smaller the initial interval should be. Continuous DRO may be chosen whenever the initial rate of the target behavior is very high.

In applied settings, researchers have not examined the relative effectiveness of fixed versus interval schedules within the DRO procedure. Research conducted in the laboratory however does indicate that fixed-interval schedules are very effective in decreasing responding, particularly with behaviors occurring at a high rate. With behaviors occurring at low rates, typically found in applied settings, variable DRO should be sufficiently effective (Le Blanc, Reuter, Miller, & Schilmoeller, 1977).

Several variations of the DRO procedure appear in the literature: DRI (differential reinforcement of incompatible behavior), DRL (differential reinforcement of low rates of responding), DRH (differential reinforcement of high rates of responding) and DRP (differential reinforcement of paced responding). Differential

reinforcement of low rates of responding will not be reviewed here since it is discussed in another chapter. Because the DRH and DRP contingencies are seldom referred to in the literature, they also will not be discussed.

The focus will be on DRO and DRI (sometimes referred to as counter-conditioning). The primary difference between the two is simple: whereas the use of DRI requires that "incompatible" behaviors be reinforced, the use of DRO does not necessarily require the specification of the "other" behaviors that are to be reinforced. However, "other" behaviors can and should be identified when using DRO. The obvious disadvantage of using DRO without specifying the appropriate behavior(s) to be reinforced is the possibility of developing superstitious behaviors through accidental conditioning (i.e., inadvertently increasing the rate of a response by delivering a reinforcer, noncontingently, after its occurrence). To prevent such accidental conditioning, reinforcement should not be made contingent upon "any other" behavior, but contingent upon certain behaviors defined by the researcher. Whenever these specified behaviors are incompatible with the target behavior, the procedure is then referred to as DRI. In both cases the rate of the target behavior is decreased while the rate of the "other" or "incompatible" behaviors(s) is increased by reinforcing only the latter. Because many researchers do not always distinguish DRO from DRI, a distinction between the two will not always be made in the present chapter. However, it should be pointed out that incompatible behaviors directly compete with the target behavior, whereas "other" behaviors may not.

DRO as a Control Procedure

Differential reinforcement of other behavior is also often used as a control procedure in behavioral research to examine the effectiveness of a reinforcer on a behavioral response. When so used, the procedure is referred to as a "reversal" ABAB design. Typically, an ABAB design refers to the withdrawal of the reinforcer or treatment variable, and not to an actual reversal of the reinforcement procedure. In the withdrawal design, baseline observations are recorded on the target behavior during the initial "A" phase without intervention; treatment is implemented during the first "B" phase while observations are still being recorded. The experimenter returns to baseline conditions by withdrawing the treatment during the second "A" phase; and treatment is again applied in the last "B" phase. Although few researchers make this distinction, this design is more appropriately called a "withdrawal" design than a reversal design (Leitenberg, 1973).

In a true reversal design, treatment is not withdrawn in the second "A" phase, but instead the reinforcement procedure used in phase B is "reversed" by differentially reinforcing behaviors that are incompatible with the target behavior. As in the withdrawal

design, the use of DRO (or DRI) enables the experimenter to demonstrate environmental control by showing that the reinforcer or treatment is directly responsible for increases in behavior. The advantage of using DRO as a control technique is that its effects are usually more immediate and durable than when withdrawal (extinction) or noncontingent reinforcement are used (Zeiler, 1971; Goetz, Holmberg, & LeBlanc, 1975).

Leitenberg (1973) cited a study by Allen, Hart, Buell, Harris, and Wolf (1964) as an excellent example of a true ABAB reversal design. A 4 1/2-year-old girl who seldom interacted with her peers was the subject. The researchers hypothesized that the teachers were unintentionally reinforcing social withdrawal by attending to her when she was alone rather than when she was playing with her peers. Therefore, the treatment consisted of providing teacher attention (praise) contingent upon her interaction with other children. Baseline observations were recorded in the initial "A" phase and contingent teacher attention was used in the first "B" phase. In the second "A" phase, a "true" reversal of the reinforcement contingency was instituted. That is, "isolate behavior" was differentially reinforced with teacher attention and interaction with peers was ignored. The frequency of isolate behavior increased with the reversal procedure and the frequency of peer interaction decreased. In the second "B" phase, the treatment was reinstated and the improvement in social interaction found in the first "B" phase intervention period was regained. The use of the reversal procedure in the second "A" phase clearly demonstrated that the shift of teacher attention was directly responsible for the changes in behavior. Another excellent example of the use of DRO as a control procedure is a study by Rowbury, Baer, and Baer (1976). This study showed that when access to play and snacks was made contingent upon task completion, completion rates steadily improved. When reinforced for not completing the academic tasks (DRO), the rates dropped. Thus, the application of DRO demonstrated the effectiveness of the reinforcers employed.

Review of Applied DRO Studies

Differential reinforcement of other behavior has been shown to be an effective procedure in decreasing many kinds of inappropriate behaviors, including self-injurious behavior, self-stimulation, stereotypic responding, aggression, swearing, seizure disorders, and a variety of inappropriate classroom behaviors (talking-out, out-of-seat, etc.). The following review of the literature covers those studies that have used DRO either alone or as part of a larger treatment package to reduce excess behaviors.

Self-injurious Behaviors, Self-Stimulation, and Stereotypic Responding

Several studies have reported success with using DRO alone in the treatment of self-injurious and self-stimulatory behaviors. Ragain and Anson (1976) eliminated the scratching and headbanging of a severely retarded girl by differentially reinforcing other behaviors. In another study by Frankel, Moss, Schofield, and Simmons (1976), a DRO program was applied after two different time-out procedures were found to be only minimally successful. The DRO program was associated with a rapid reduction in the rates of aggression and head-banging in a profoundly retarded six-year-old girl. Likewise, Repp, Deitz, and Deitz (1976) showed that DRO can be a useful procedure in reducing such self-stimulatory behaviors as hair-twirling, hand-biting, and thumb sucking. The experimenters reinforced three retarded children with teacher praise contingent upon a given interval of time (ranging from 30 seconds to 5 minutes) having elapsed without the subjects emitting self-stimulatory behaviors. Using a DRO procedure, Mulhern and Baumeister (1969) reduced the rocking behavior of two retardates by reinforcing the subjects when they were sitting still. Although this procedure reduced rocking by about one-third, it did not eliminate this form of self-stimulation.

Several studies have found DRO to be highly effective in the treatment of thumb-sucking with normal children (Skiba, Pettigrew & Alden, 1971; Knight & McKenzie, 1974). Skiba et al. reduced the thumb-sucking behavior in two or three third-grade girls in a classroom using teacher attention contingent upon behaviors incompatible with thumb-sucking (writing and folding hands). Likewise, Knight and McKenzie eliminated the thumb-sucking of three girls by differentially reinforcing non-thumb-sucking on a continuous schedule. Reading stories was contingent upon non-thumb-sucking. This study was one of the few that used the children's parents as experimenters.

Although the above studies supported the usefulness of DRO, other studies have shown DRO, when used alone, to be less effective than other behavioral procedures in the treatment of self-injurious behavior and self-stimulation. Corte, Wolf, and Locke (1971) studied the usefulness of DRO, extinction, and punishment in reducing self-injurious behavior. They found that DRO was ineffective when food was used as a reinforcer under the condition of no food deprivation, but was effective with one of the two institutionalized profoundly retarded adolescents under mild food deprivation conditions. The use of extinction through the withdrawal of social consequences was totally ineffective, while on the other hand, electric shock punishment was successful in eliminating self-injurious behavior. Likewise, with two severely retarded girls who self-stimulated by mouthing either objects or their hand(s), Foxx and Azrin (1973) found free

reinforcement and reinforcement for non-mouthing (DRO) to be the least effective of the five procedures they tried. Punishment (slapping the hand), the application of a distasteful solution, and especially over-correction were more productive procedures.

Harris and Wolchik (1979) systematically examined the relative effects of DRO (praise and edibles for incompatible behaviors), time-out, and over-correction with four autistic-like children in the treatment of self-stimulation. As in the Foxx and Azrin study, over-correction was convincingly superior to the other procedures. Although DRO was minimally successful in reducing self-stimulation with one boy, it had no effect on the behavior of two others, and was actually associated with an increase in self-stimulation with the fourth child. Moreover, in a study by Measel and Alfieri (1976), DRI alone did not have a significant effect in the treatment of head-slapping and head-banging in two profoundly retarded boys, but the combination of over-correction and DRI eliminated such behavior with one of the two boys. With the other boy, the rate of head-banging actually increased during treatment with DRI alone and also during DRI with over-correction. The results led the researchers to question the varying effects of the two procedures.

Repp and Slack (1977) reported several factors which may have contributed to the ineffectiveness of DRO found in the above studies: individual differences, reinforcement histories, lack of effectiveness of the selected reinforcers, and unscheduled reinforcers occurring after the response to be decreased. They hypothesized that another critical factor that affects the success or failure of DRO is the initial size of the DRO interval used in the program. To test their hypothesis, Repp and Slack examined responding when three different initial values were used: DRO 1-, 12-, and 20-seconds. The three moderately retarded children who were studied made fewer total responses when the interval was one second than when the interval was 12 or 20 seconds. The researchers noted that their results may explain why the studies by Corte, Wolf, and Locke (1971), Foxx and Azrin (1973), and Harris and Wolchik (1979) did not find DRO to be effective: the initial DRO intervals were too great. Thus, in using DRO in an applied setting, psychologists would be wise to use a short rather than a long initial DRO interval to decrease high rates of responding more quickly.

Differential reinforcement of other behavior appears to be most effective in reducing excessive responding when used in combination with other behavioral techniques. The concurrent use of DRO and other deceleration techniques results in more immediate and lasting decreases in responding than when DRO is used alone. In reviewing the behavioral research on self-injurious behavior, Bachman (1972) noted that differential reinforcement of non-self-injurious behavior when combined with punishment has consistently been found to be a powerful deceleration procedure.

Punishment (particularly electric shock) has often been viewed with a great deal of distaste by experimenters, nevertheless, it does have the advantage of producing immediate and consistent results (Lovaas & Simmons, 1969). A study by Romanczek and Goren (1975) demonstrated the effectiveness of using both DRO and punishment in the treatment of self-injurious behavior. After an unsuccessful attempt at using DRO alone, the researchers combined DRO (food, physical contact, and praise were reinforcers) with electric shock in eliminating chronic and severe self-injurious behavior of a six-year-old autistic boy. It should be noted however that the generalization of control to the natural environment was only moderately successful, a problem frequently found in the treatment of severe self-injurious behavior.

Other deceleration procedures less distasteful than physical punishment have also been found to be effective when combined with DRO. Several studies (e.g., Lovaas, Schaeffer, & Simmons, 1965; Repp & Deitz, 1974) have reported success using DRO with time-out. In this procedure the subject is isolated immediately and briefly from attention following the occurrence of self-injurious behavior and is positively reinforced for non-self-injurious behavior. Using DRO in conjunction with the verbal stimulus of shouting "no" following self-injurious behavior (a mild form of punishment), was found to be effective by Repp and Deitz (1974). The application of over-correction procedures has also been shown to an excellent alternative to the use of physical punishment. For example, Measel and Alfieri (1976) combined over-correction and DRI in the successful treatment of self-injurious behavior. Likewise, DeCatanzaro and Baldwin (1978) decreased the head-hitting in two profoundly retarded boys to near-zero levels by combining a DRO schedule with the required practice of repeated arm movements following each response of head-hitting.

Several studies have used DRO as part of a treatment package to reduce various stereotypic or ritualistic behaviors. Differential reinforcement of other behavior and physical restraint were employed in a classroom by a teacher with no previous experience with behavior modification to successfully eliminate a high rate of stereotypic body contortions of a nine-year-old moderately retarded girl in a study by Barkley and Zudnick, (1976). Repp, Deitz, and Speir (1974) combined the differential reinforcement of behavior other than stereotypic responding with the presentation of the verbal stimulus "No" when stereotypic responding occurred to quickly and substantially decrease the stereotypic behaviors (lip-flapping, rocking, and hand motions) of three severely retarded persons. Repp et al., who as noted earlier used this technique to reduce self-injurious behavior, recommended the inclusion of the stimulus "No" in the DRO procedure when dealing with self-injurious, self-stimulatory, or stereotypic behaviors. As stated by Repp et al. "This particular verbal stimulus changes the situation such that a concurrent

schedule is in effect, where one response class (stereotypic responding) leads to one consequence ("no!" plus timer reset) and an incompatible response class (anything except the stereotypic responding) leads to another consequence (reinforcement.) "No!" consistently identifies the response that delays reinforcement and is so easy to arrange that whether DRO alone can be as effective as DRO plus "no!" becomes a question of academic rather than of practical importance "(p. 283). Thus, it should be helpful to use a verbal stimulus whenever DRO is applied in the treatment of self-injurious and similar excessive behaviors.

Swearing, Aggression, and Other Undesirable Behaviors

Combining a brief time-out (two minutes) with DRO, Bostow and Bailey (1969) significantly reduced the screaming, shouting, and loud cursing of a 58-year institutionalized retarded patient. The experimenters also used time-out with DRO to decrease to near-zero levels the severe aggressive behavior of a seven-year-old institutionalized boy. With this procedure, the boy was immediately placed in a time-out booth following aggressive behavior (biting, kicking, etc.) for two minutes and was concurrently reinforced for nonaggressive behavior with edibles contingent upon the elapse of two minutes without aggressive behavior. Feindler and Elder (197) compared a response-cost procedure (fines resulting in the loss of privileges) with DRO (reinforcement contingent upon the absence of fines) and found DRO to be much more effective than response-cost in reducing the frequency of swearing with three emotionally disturbed children. A treatment package consisting of satiation, positive-practice overcorrection and DRO was found to be effective in eliminating the chronic clothes ripping of six emotionally disturbed mentally retarded residents in a study by Carroll, Sloop, Mutter, and Prince (1978). In a study by Zlutnick, Mayville, and Moffat (1975) the application of DRI resulted in a rapid decrease in the frequency of epilepic seizures in a 17-year-old retarded female. Whitehead, Renault, and Goldiamond (1975) showed that DRO can even be used to decrease high rates of gastric acid secretion in the stomach, a cause of ulcers, by reinforcing (with money) reduced secretion.

In treating the chronic separation anxiety of a four-year-old girl in a preschool setting, Neisworth, Madle, and Goeke (1975) differentially reinforced the girl for nonanxious behavior with the mother's reappearance, which was gradually faded by increasing the interval of time between the mother's disappearance and subsequent reappearance. The combination of DRO and stimulus fading resulted in the successful elimination of the problem.

Inappropriate Classroom Behavior

The research studies reviewed so far have typically used the DRO procedure in environments outside of the public school. Because these studies have generally demonstrated the effectiveness of DRO in the treatment of a wide array of behaviors

in other settings, it is rather surprising that relatively few researchers have systematically applied DRO in the reduction of common behavior problems in the regular classroom. Those studies in which DRO was used in the classroom have largely focused on the treatment of retarded or emotionally disturbed children in special classrooms. For example, Poling, Miller, Nelson, and Ryan (1978) applied DRO with three moderately retarded students attending a self-contained classroom to reduce several undesired behaviors (i.e., drooling, hitting, throwing objects, leaving one's seat without permission, and placing hand(s) near the mouth). Repp, Deitz, and Deitz (1976) also decreased the rate of inappropriate classroom behavior ("talk-outs") in three mildly retarded third graders. Reinforcement, which included tokens exchangable for activities and refreshments, was contingent on the absence of talk-outs during three-minute intervals. Using these same contingencies in another study conducted within the classroom, the shouting and talking-out of a 13 year old educable mentally retarded boy was rapidly decreased (Deitz, Repp, & Deitz, 1976).

Differential reinforcement of low rates of responding (DRL) was compared with DRO in several experiments by Hummel, Deitz, Sundrup, and Wagner (1977). Both procedures were effective when used alone; DRO reduced talk-outs and DRL reduced fighting. When DRL and DRO were compared in an ABAC design used to examine their relative effectiveness in the classroom management of verbal interruptions, DRO was more successful. However, it is interesting that the experimenters reported that the teachers and students preferred the DRL procedure because with DRL "superstitious" behaviors were less likely to be reinforced and the demands of DRL were less stringent.

An impressively successful classroom management technique that usually employs a DRL schedule is the "Good Behavior Game" (Barrish, Saunders, & Wolfe, 1969; Harris & Sherman, 1973; Johnson, Turner, & Konarski, 1978; Hegerle, Kesecker, & Couch, 1979; Bear & Richards, 1980). In this technique the entire class, or selected teams of students within the class, are differentially reinforced contingent on decreased rates of inappropriate behaviors. For example, a class may earn extra free-time if less than 10 inappropriate behaviors are exhibited by the class during a 30 minute period. When reinforced for the absence, instead of a low rate of inappropriate behavior, the schedule technically becomes a DRO schedule. The present writer has experienced much success with the "Good Behavior Game" in reducing talking-out and out-of-seat behavior in the regular classroom. Those school psychologists who are not familar with this technique are encouraged to refer to the chapter of this book on DRL which reviews the Good Behavior Game and similar procedures.

In summary, many studies have shown DRO to be quite powerful in reducing various kinds of undesirable behavior. The results

of using DRO have particularly been impressive when used in combination with other behavioral techniques, such as with overcorrection in dealing with autistic behaviors (Kauffman, 1977). Whenever punishment, response cost, time-out, overcorrection, or other deceleration techniques are used, the psychologist should include DRO as part of a total treatment package.

Guidelines for Using DRO

In this section the procedures necessary for implementing the DRO procedure in a reliable and systematic manner are described. Although abbreviated and simplified, the guidelines attempt to provide the school psychologist with the basic information needed to reduce excessive behaviors in the classroom. The five phases outlined may also be helpful when considering the use of behavioral techniques other than DRO.

Initial Planning

Identify the target behavior and the behavioral objectives. Although this step may strike some readers as being insignificant and perhaps a waste of valuable time, the cost of neglecting it can be devastating to the treatment. It should not be assumed that the teacher, parent, or whoever is assisting with the program, knows exactly what and what not to reinforce. Problems commonly arise when the interventionist unintentionally reinforces inappropriate behaviors or fails to reinforce the right behaviors because it is unclear what exactly constitutes the target behavior. Although perhaps necessary for publishing research, the psychologist does not need to write elaborate and precise definitions. However, a clear and simple description and explanation of the target behavior may be needed to help prevent problems from developing in the client's environment.

As stated earlier, a shortcoming of the true DRO procedure is that "any behavior" other than the target behavior is to be reinforced. Consequently, it is possible that superstitious behaviors or other inappropriate behaviors may be conditioned. To prevent this problem from developing, the school psychologist should make sure that other "appropriate" behaviors are reinforced, and not just any other behavior. What constitutes appropriate and inappropriate behaviors should be stated not only to the teacher, but should also be explained to the child.

The objectives of the program should be defined prior to implementing the program. Depending on the target behavior, one objective or a series of graduated goals should be stated. An

important question to ask is "Are the objectives realistic?" Should you expect Susan's excessive tardiness to decrease immediately to a zero level or is a gradual decrease more realistic? The use of behavioral objectives could save the school psychologist, teacher, parents, and student from later disagreeing over what is "success."

Identification of the target behavior and the objectives of the program should result from behavioral consultation with the teacher, parent, and classroom observation. Besides identification, the consultation and observation should focus on antecedent events and the consequences of the target behavior in order to help the interventionist better understand the conditions that control the behavior and to facilitiate the selection of the most appropriate intervention strategy.

Example: The problem is reported by the classroom teacher as being Mark's "poor conduct" during the daily arithmetic period. After behavioral consultation with the teacher and several classroom observations, the primary target behavior is identified as Mark's talking without permission. Appropriate behavior is defined as working quietly on his assignment. The terminal objective is his working without talking for 30 minutes during arithmetic unless he receives permission from the teacher to talk, since others in his class are expected to do the same. Both the school psychologist and teacher agree that immediate improvement should be expected, but that the terminal goal will be not obtained until approximately four to six weeks.

Selection of Deceleration Procedures

Behavioral techniques other than DRO should be considered at the planning phase in the program. Selection depends on the kind of target behavior, its frequency and severity, the behavioral objective, as well as other important factors (ethics, cost, convenience, reinforcement history, controlling variables, etc.). What the teacher believes is "appropriate" behavior should also influence the choice of procedures. For example, if the teacher can tolerate and is satisfied with the low rate of talking, but is only concerned about excessive amounts of talking, then a DRL procedure may be more suitable than DRO. Likewise, a punishment procedure or another deceleration procedure, with or without the use of DRO, may be more effective than DRO used alone. Other deceleration procedures that should be considered in the treatment of excessive behaviors include extinction, discrimination training, punishment, time-out, satiation, response cost, restraint, overcorrection, and stimulus change. Several of these deceleration procedures are presented elsewhere in this book. Gelfand and Hartmann (1975) review each of these procedures, including their applications, advantages, and disadvantages, in their book, **Child Behavior Analysis and Therapy**, which is highly recommended for those with minimal backgrounds in applied behavior analysis.

Gelfand and Hartmann (1975) note certain conditions governing the choice of deceleration procedures. Three important prerequisites for DRO (as well as for some other deceleration procedures) are: a) the experimenter knows and can control the reinforcer, b) the behavior is maintained on a rich intermittent reinforcement schedule or a continuous reinforcement schedule, and c) the continued occurrence and temporary increase in the rate of the target behavior can be tolerated. If these conditions do not exist, Gelfand and Hartmann suggest the consideration of punishment, restraint, or stimulus change. Obviously, ethical concerns regarding the use of deceleration procedures should also influence one's choice.

Example: In the hypothetical case with Mark, the school psychologist discusses with the teacher the available options of deceleration techniques that should be effective: punishment, response cost, stimulus change, timeout, extinction, and DRO. Based on classroom observation and the analysis of the antecedents and consequences of the target behavior, the three prerequisite conditions for using DRO stated above are found to characterize the behavior: 1) the reinforcer (teacher and peer attention) can be controlled, 2) the talking occurs frequently, and 3) although not desirable, the talking can be tolerated, at least for a while. Differential reinforcement of other behavior is also selected because the teacher believes that it has certain ethical advantages (using reinforcement instead of punishment) and appears to be easy to implement. It is further decided that Mark's desk should be moved (stimulus change) to a less distractable place in the room, away from close friends and near better models. This is decided upon because it was observed that the closeness of his friends appeared to be both a stimulus and a reinforcer of his talking. Thus, a combination of stimulus change and DRO is to be used to decrease Mark's excessive talking during arithmetic.

Determine the Reinforcer and the DRO Interval

The correct use of an effective reinforcer is absolutely necessary for DRO to be successful. By definition a reinforcer must increase the strength of a response. Reinforcers that can most easily be used in treatment have the following characteristics: a) resistance to satiation (e.g., better to choose exchangable tokens and not food, b) the reinforcer can be administered in small units (e.g., give one token after correct behavior, not a giant candy bar), c) it can be administered immediately after the occurrence of the desired behavior, d) the administration of the reinforcer is exclusively under the treatment agent's control (e.g., don't choose something that the child can freely get elsewhere), e) the reinforcer is compatible with the treatment program (e.g., "do not use peanut butter as a reinforcer in a speech articulation program"), and f) the reinforcer is practical (Gelfand & Hartmann, 1975).

Two categories of reinforcers are commonly differentiated: primary and secondary reinforcers. Primary reinforcers (or "unconditioned" reinforcers) consist of such things as food, water, comfort, etc. Secondary reinforcers ("conditioned" reinforcers) such as tokens, money, grades, points, etc., are the more commonly used reinforcers in treatment programs, mainly because they usually have the six characteristics cited above. Social reinforcers (praise, attention, etc.) are powerful secondary reinforcers both inside and outside of the classroom. The appropriate reinforcers to be used in the DRO procedure can be determined in two ways: by observing the child and by interviewing the child and/or his teacher and other caretakers. In an interview the child can be asked questions regarding what he finds reinforcing or can be presented with a checklist, or a "reinforcement menu" that lists possible reinforcers to choose.

After determining reinforcers, the next step is to decide the length of the DRO interval (i.e., the interval of time that must pass without the target behavior occurring in order for the reinforcer to be given). During this interval the target behavior is to be ignored (unless DRO is combined with another technique such as punishment). At the end of the interval the child receives reinforcement provided that the target behavior did not occur during the entire interval. The response rate of the target behavior prior to intervention and the practicality of the interval length are the two most important factors that determine the length of the DRO interval.

Repp, Deitz, and Speir (1974) recommend that the initial DRO interval be the mean interval between responses occurring during baseline. This value is derived by either averaging the latencies between baseline responses or by calculating the inverse of the mean baseline response rate. For example, if during baseline the mean response rate is two "talk-outs" per minute, the DRO interval would be 30 seconds (one minute divided by two talk-outs). The more frequently the behavior occurs, the shorter the DRO interval should be. If the behavior occurs at an extremely high rate (e.g., nearly constant self-injurious behavior), reinforcement of other behavior should initially be continuous. As the behavior improves, the DRO interval should be lengthened (this is technically referred to as an "escalating DRO schedule"), requiring the child to refrain from emitting the inappropriate behavior an increasingly greater length of time in order to be reinforced.

As with any form of classroom intervention, the intervention is likely to fail if it is impractical or not endorsed by those using the technique. If a classroom teacher maintains that she cannot reinforce the child at the recommended DRO interval, her opinion should be respected. It may then be necessary to consider other deceleration procedures that require less time, offer to implement the program yourself, or begin with a DRO interval

greater than the mean interval between baseline responses. An approach used by the author that was found to be effective in the past is explaining to the teacher that the shorter the initial interval the better, that a very long interval will not work at all, and then ask the teacher to help determine the shortest interval that can reasonably be expected in the classroom. Having the teacher play an important role in the planning as well as the implementation of the program may not guarantee success, but it does help prevent the development of ill-feelings toward the psychologist. The teacher, and not only the school psychologist, then feels partially responsible for either the success or the failure of the treatment.

Example: As a result of observations and interviews with Mark, the most appropriate reinforcers pinpointed are teacher attention and free time. A point system is arranged in such a manner that Mark will be awarded a specified amount of points to be recorded on the chalkboard at the end of each DRO interval, providing that no talking-out occurs and that he is working quietly in his assignment at that time. The points are to be accompanied with teacher praise. A maximum of six points can be earned. Since six points maximum can be earned over the 30 minute period, one point can be earned each five minutes (one point multiplied by 6-five minute intervals equals six points possible). The points earned can be carried over the next day and when 12 points are accumulated, Mark can trade them for ten minutes of free time which will follow the arithmetic session. In agreement with the teacher, an escalating DRO design is chosen. Although his mean response rate prior to intervention is calculated as being one talk-out every three minutes, the teacher does not believe that time permits her to attend to Mark every three minutes. Therefore, an initial DRO interval of five minutes instead of three is decided upon. After two consecutive days of no talking-out having occurred, the interval length will be increased, first from 5 to 10 minutes, then from 10 to 15 minutes, and finally to a 30 minute interval. It should be noted that both social praise and the point system have the six characteristics of effective reinforcers that were reported earlier.

Measurement and design

Interval recording is the most commonly used method for recording the treatment effects of DRO. The interval method has the advantages of providing more reliable data than other methods and being applicable to a wide variety of responses. As stated by Gelfand and Hartmann (1975, p. 59) "To use the interval method of recording, break the observation period into small equal intervals and record whether or not the behavir is observed to occur in each interval. The interval size will usually be from five seconds to one minute in duration, depending upon (a) the rate of the response and (b) the average duration of a single response. For high rate behaviors, the interval should be sufficiently small so that two complete responses could not occur in a single interval.

On the other hand, the interval should be at least as long as the average duration of a single response." Measures obtained from interval recording are most accurate when the interval length is 10 to 30 seconds. Because small intervals are usually necessary, reliable interval recording is often impractical in the classroom and is mainly recommended when the focus of the program is research. Asking a teacher to record data during intervals under five minutes will often result in teacher resistance. If such recording is necessary for research purposes, the school psychologist or an assistant may have to record the interval data. To record interval data, the recorder can use data sheets published in many journal articles and books on applied behavior analysis or devise a data sheet.

Although usually less accurate and reliable, methods other than short interval recording that require less time and effort can effectively be used in the classroom. For example, large time intervals could be used. The teacher or the student could be asked to record at the end of five or ten minute intervals whether or not the target behavior occurred. For convenience, the recording interval could coincide with the DRO interval so that the recorder only has to record whether or not reinforcement was earned at the end of each DRO interval. Another alternative is the tally method, recording the number of times the behavior occurs. The weakness of this method however is that when measuring an indiscrete and non-uniform behavior such as talking, the measures are often inaccurate and low interobserver agreement is obtained. In some cases, the duration method could be easily employed, for example, when the concern is <u>how long</u> it takes the child to begin or complete an assigment.

To publish the results of behavioral intervention, measures of reliability, or interobserver agreement, are almost always required. Interval data is best suited for this purpose. However, because precise reliability measures are often difficult to obtain by most school psychologists and are not necessary for an intervention to be effective, such measures should only be a prime concern when the psychologist desires to publish the data, the reliability of the data is seriously questionable, or when resources allow the systematic collection of interval data by two or more experimenters.

The school psychologist desiring to demonstrate that changes in the target behavior occurred and that the intervention was responsible for the changes will more than likely consider using one of the two most commonly employed experimental designs, the ABAB design and the multiple baseline design. It is beyond the scope of this chapter to review the many variations of these designs. For a comprehensive and indepth review of single subject experimental designs the reader is referred to Hersen and Barlow (1976). Several advantages and disadvantages of both techniques when used in the classroom for non-research purposes should be noted:

1. The classroom teacher may resist (perhaps rightfully so) the withdrawal or reversal of the treatment in an ABAB design. Teachers are usually not as concerned about showing what caused the changes as they are about the simple fact that the behavior improved. Thus, although experimentally lacking, all that may be needed in the classroom is an AB design.

2. The teacher may not want to wait for baseline data to be collected before helping the child. The psychologist should attempt to collect baseline data during the initial planning stage when classroom observations are being recorded. Three data points will often suffice if the baseline data clearly show the need for treatment.

3. When an ABAB design is not possible because baseline conditions cannot be reinstated either because of ethical considerations or because the behavior is irreversible, the multiple baseline design may be an excellent alternative. However, it should be noted that the multiple baseline design requires much more data recording, requires that the rates of the target behaviors be independent of each other, and should not be used unless "two or more responses for a single child, or a single response in either two or more settings or for two or more children, are available" (Gelfand & Hartmann, 1975, p. 95).

Example. The school psychologist decides to use two methods of data collection, interval and tally. Tally data will be obtained by the teacher, the student, and the school psychologist. Each person records a mark on a data sheet each time a "talk-out" occurs. The tally data are collected mainly as a simple method of having the teacher and Mark monitor and chart the target behavior and because the psychologist knows that charting and graphing by itself often changes behavior. At the end of each arithmetic period the teacher and Mark will compare their data. For research purposes, interval data will also be collected by the school psychologist and an assistant (e.g., practicum student, teacher aide, another student, etc.) trained by the psychologist in behavior observation. Each 30 minute arithmetic period is divided into 120 15-second intervals. Thus, the observer records whether or not Mark talks without permission during any part of each interval. Twice weekly the psychologist and his/her assistant record at the same time in order to establish a measure of interobserver agreement.

Since the teacher agrees that a few days without intervention can be tolerated, an ABAB design is chosen. Initial baseline data were collected during the week that the program was being planned. It is decided that baseline conditions can be reinstated after the terminal goal of no talking is observed for three consecutive days of intervention. The return to baseline conditions will be for three to five days (depending on the consistency of the data recorded), and will be followed by the reinstatement of intervention.

If the teacher had resisted the withdrawal of treatment, a simple AB design may have been necessary. A multiple baseline design was not applicable because only one student displayed only one significant behavior problem in one setting.

Implementing the Program

The time and effort spent in the design phase will be worthless unless the DRO program is implemented correctly. Since most teachers want immediate results and may not tolerate the continuation of a program that does not appear to be improving behavior, demonstrating success the first or second week is often crucial. The chances of success may be increased substantially if the psychologist implements the treatment the first few days or until improvement begins. This also allows the psychologist to model the proper use of DRO. If DRO reduces behavior problems when used by the psychologist, the teacher will feel more confident about using the treatment. If the treatment is not effective when used by the psychologist, it will be unrealistic to expect the teacher to use DRO. The psychologist should also observe the teacher the first day or two that the teacher uses DRO and offer constructive criticism.

Recording the behavior observations daily on a graph provides the psychologist and the teaher with an objective means of monitoring the effectiveness of the program. If after about a week (depending on the behavior and its severity) of unsuccessful treatment, the DRO program should be modified or another deceleration technique should be tried. The reason for waiting as long as one week before changing the program is that with DRO an initial increase in responding can be expected with some behaviors (e.g., self-injurious behavior) before there is a significant decrease. If the program is being implemented correctly but does not succeed after several days or one week, two simple modifications of the program may be necessary. First, the DRO interval may need to be shortened. If the DRO schedule is too lean (i.e., reinforcers are delivered too infrequently) improvement will not occur. Secondly, if behavior still does not improve, the psychologist may want to try other reinforcers. If these changes do not help, other deceleration procedures should be combined with DRO to produce changes in behavior.

Phasing the Program Out

The major objective in phasing out a behavior modification program is to ensure that the behavioral gains are maintained. Four general techniques that can be used to help prevent the target behavior from returning to the pre-DRO treatment level are (Wallace & Kauffman, 1973):

1. **Gradually reducing the frequency and amount of reinforcement.** This can be done by gradually shifting to leaner or more intermittent schedules of differential reinforcement. Near the end of the program the interval used should approximate the interval found in the child's natural environment.

2. **Using intermediate reinforcers to gradually delay reinforcement.** The use of intermediate reinforcers such as tokens or a point system allows one to gradually delay the interval of time between the occurrence of "appropriate" behavior and a larger or a more desired reinforcement.

An example of using both of the above techniques is gradually increasing the average length of the DRO interval and at the same time requiring more points to be earned before a chosen reward is received.

3. **Gradually fading artificial to natural reinforcers.** Artificial reinforcers (e.g., tokens, points, money, candy, etc.) should be phased out by gradually shifting to the use of natural reinforcers (e.g., attention, praise, grades, recess, etc.).

4. **Reinforcing self-control behaviors.** The child should be taught methods of monitoring and controlling his/her own behavior. Self-control techniques have many advantages when used in the classroom. The most important advantage is that they teach the child to be responsible for managing his/her own behavior.

These four techniques not only help ensure the maintenance of improvement but also facilitate the generalization of the behavioral gains resulting from DRO to other settings. Their use should be considered during the initial planning stage of the DRO program.

Example of implementing and phasing-out the DRO program. Baseline data were collected over four days while the program was being planned (four instead of three days were used because of a declining trend in the data). Prior to the beginning the program the procedures were explained to Mark. During the first two days of intervention, the school spychologist directly instituted the treatment as a way of training the teacher. Mark's desk was moved (stimulus change) and a DRO program was used. As planned, the length of the initial DRO interval was five minutes and was subsequently increased each time that two consecutive days passed without Mark having talked-out during arithmetic. When appropriate, Mark was praised at the end of each DRO interval and was given a predetermined number of points based on the length of the interval (one point for DRO 5', two points for DRO 10', three for DRO 15', and six points for DRO 30'). Every time Mark accumulated twelve points he exchanged them for ten minutes of free time. To cue the participants when the DRO interval had ended, at the beginning of each DRO interval a kitchen timer was set at the prescribed interval length. The person implementing the program and Mark tallied the number of talk-outs that occurred during intervention and plotted them on a graph each day.

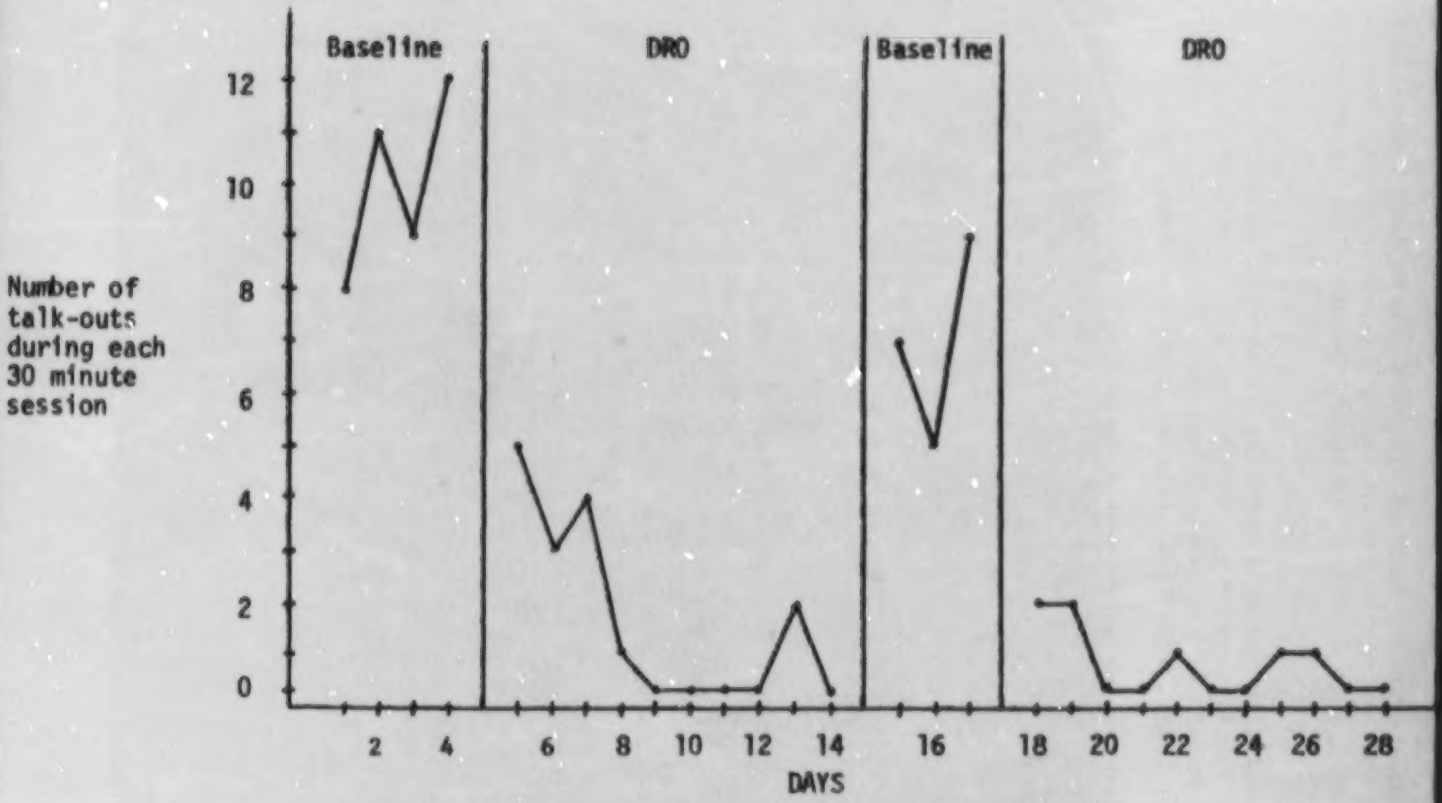


Figure 1. Results of the DRO procedure on Mark's talking-out behavior. The initial DRO interval of 5 minutes was increased following two consecutive days of no talking to intervals of 10 minutes (days 11,12), 15 minutes (days 13, 14, 18, 19, 20, 21) and minutes (21 - 28).

If this program had actually been implemented, one would expect the data to be similar to the hypothetical data presented in Figure 1. As can be seen, the frequency of talking-out steadily decreased from an average of 10 every 30 minutes during baseline to an average of 1.5 during the first phase of intervention. When baseline conditions were reinstated, talk-outs increased to an average rate of 7.0, and finally decreased to fewer than one every 30 minutes when DRO was once again implemented. If the results of interval recording had been plotted (i.e., the percent of intervals in which talking-out was observed), the results would have been more precise but roughly the same as that shown in Figure 1.

The use of several "phasing-out techniques" that were included as part of the actual treatment program increases the likelihood that the behavior improvements would be maintained. The use of the point system facilitated the gradual reduction of reinforcement. The DRO interval was systematically lengthened until the teacher had to attend to Mark only at the end of each arithmetic period. At which time the point system could have been dropped and replaced entirely by the "natural" reinforcers of praise and free time. Self-monitoring was also included to encourage Mark to manage his own behavior more effectively.

Advantages and Disadvantages of DRO

The majority of psychologists engaged in behavior modification are well aware of the legal and ethical issues pertaining to the "control" of human behavior. Perhaps justifiably, coercive behavior modification procedures, particularly corporal punishment, have been the subject of most of the criticism. Extinction and other punishment techniques are frequently viewed aversely and resisted by the child, parent, and other participants. On the other hand, although not free of legal and ethical restrictions, those procedures involving the use of positive reinforcement contingencies are received more favorably. In many cases this alone is sufficient reason for using a strategy of DRO instead of other more coercive deceleration techniques.

Another advantage is that unlike other deceleration techniques, the amount of positive reinforcement the child typically receives is not reduced, but is usually increased when DRO is applied. As stated by Gelfand and Hartman (1975), rarely do you want to use punishment or extinction alone since you ".....ordinarily do not want to reduce the net total of reinforcement the child is receiving. A behavior that is eliminated is not

generally replaced by no behavior. It may be replaced by some other performance that might be equally undesirable if you do not take pains to see that the subject learns a socially appropriate alternative behavior" (p. 163).

Instead of using extinction alone to eliminate tantrums, the psychologist would be wise to use DRO instead. For example, tantrums would be ignored but more desirable behaviors would also be systematically reinforced. Differential reinforcement of other behavior is an excellent alternative to extinction. There are few, if any, cases in which extinction would be used without also differentially reinforcing appropriate behavior. Differential reinforcement of other behavior not only results in a more immediate decrease in behavior but may also have a more lasting effect than would extinction alone.

Other advantages of DRO were presented throughout the chapter: it can be applied to decrease a wide variety of inappropriate behaviors in different settings, it can easily be phased-out and replaced by "natural" contingencies which facilitates the generalization of behavior change, and it can be used alone or in combination with any other deceleration technique. Perhaps the most salient advantage however is its simplicity of use and lasting effectiveness.

As with any other behavior modification procedure, DRO has several disadvantages. Problems which were discussed previously that may arise when using DRO can usually be avoided, if the procedure is planned and implemented as outlined earlier. Superstitious or other inappropriate behaviors may be unintentionally conditioned whenever the "appropriate" behaviors to be reinforced are not specified. If the correct reinforcer maintaining the behavior cannot be identified and controlled, DRO may not be the choice method. Likewise, it is imperative that the reinforcer selected to be used in the program truly reinforces desirable behavior. The topography of each case must be analyzed accurately to determine those variables that control both the inappropriate behavior to be eliminated and the desirable behavior to be increased.

Furthermore, another disadvantage is that DRO has not always been found to be effective. In fact, DRO has been shown to cause an initial increase in some cases of inappropriate behavior. However, as suggested by Repp, Deitz, and Deitz (1976), such reported increases were likely to have been caused by using too long of a DRO interval. Nevertheless, disadvantages do exist. Effective planning, systematic implementation, and the use of DRO in combination with other deceleration techniques, reduce the liklihood that the disadvantages will preclude the success of a DRO program.

Acknowledgment

Appreciation is expressed to Bill Wright for the helpful suggestions and comments he provided during the preparation of the manuscript.

References

Allen, K. E., Hart, B., Buell, J. S.; Harris, F. R.; & Wolf, M. M. Effects of social reinforcement on isolate behavior of a nursery school child. Child Development, 1964, 35, 511-518.

Bachman, J. A. Self-injurious behavior: A behavioral analysis. Journal of Abnormal Psychology, 1972, 80, 211-224.

Barkley, R. & Zupnick, S. Reduction of stereotypic body contortions using physical restraint and DRO. Journal of Behavior Therapy and Experimental Psychiatry, 1976, 7, 167-170.

Barrish, H. H., Saunders, M. & Wolf, M. M. Good behavior game: Effects of individual contingencies for group consequences on disruptive behavior in a classroom. Journal of Applied Behavior Analysis, 1969, 2, 119-124.

Bear, G. G. & Richards, H. C. An interdependent group-oriented contingency system for improving academic performance. School Psychology Review, 1980, 9, 190-193.

Bostow, D. E. & Bailey, J. B. Modification of severe disruptive and aggressive behavior using brief timeout and reinforcement procedures. Journal of Applied Behavior Analysis, 1969, 2, 31-37.

Carroll, S. W., Sloop, E. W., Mutter, S. & Princes, P.L. The elimination of chronic clothes ripping in retarded people through a combination of procedures. Mental Retardation, 1978, 16, 246-249.

Corte, H. F., Wolf, M. M. & Locke, B. J. A comparison of procedures for eliminating self-injurious behavior of retarded adolescents. Journal of Applied Behavior Analysis, 1971, 4, 201-213.

DeCatanzaro, D. A. & Baldwin, G. Effective treatment of self-injurious behavior through a forced arm exercise. American Journal of Mental Deficiency, 1978, 82, 433-439.

Deitz, S. M., Repp, A. C., & Deitz, D.E.D. Reducing inappropriate classroom behavior of retarded students through three procedures of differential reinforcement. Journal of Mental Deficiency Research, 1976, 20, 155-170.

Feindler, E. L. & Elder, J. P. A comparison of response-cost and DRO procedures in the reduction of swearing behavior of institutionalized adolescents. (ERIC Document Reproduction Service No. ED 013 371)

Foxx, R. M. & Azrin, N. H. The elimination of autistic self-stimulatory behavior by overcorrection. Journal of Applied Behavior Analysis, 1973, 6, 1-14.

Frankel, F. & Moss, D. Schofield, S. & Simmons, J. Q. Case study: Use of differential reinforcement to suppress self-injurious and aggressive behavior. Psychological Reports, 1976, 39, 843-849.

Gelfand, D. M. & Hartmann, D. P. Child Behavior Analysis and Therapy, New York: Pergamon Press, 1975.

Goetz, E. M., Holmberg, M. C. & LeBlanc, J. M. Differential reinforcement of other behavior and noncontingent reinforcement as control procedures during the modification of a preschooler's compliance. Journal of Applied Behavior Analysis, 1975, 8, 77-82.

Harris, V. W. & Sherman, J. A. Use of analysis of the "good behavior game" to reduce disruptive classroom behavior. Journal of Applied Behavior Analysis, 1973, 6, 405-417.

Harris, S. I. & Wolchik, S. A. Suppression of self-stimulation: Three alternative strategies. Journal of Applied Behavior Analysis, 1979, 12, 185-198.

Hegerle, D. R., Kesecker, M. P. & Couch, J. V. A behavior game for the reduction of inappropriate classroom behaviors. School Psychology Digest, 1979, 8, 339-343.

Hummel, J. H., Deitz, S. M., Sundrup, D., Wagner, M. & Silavent, V. Misbehavior in the classroom: A comparison of two reinforcement-based behavior reducing procedures (DRO and DRL). Paper presented at the annual meeting of the American Educational Research Association, 1977, (ERIC ED 139513).

Johnson, M. R., Turner, P. F. & Konarski, E. A. The "good behavior game": A systematic replication in two unruly transitional classrooms. Educational and Treatment of Children, 1978, 1, 25-33.

Knight, M. F. & McKensie, H. S. Elimination of bedtime thumbsucking in home setting through contingent reading. Journal of Applied Behavior Analysis, 1974, 7, 33-38.

Kauffman, J. M. Characteristics of children's behavior disorders. Columbus, Ohio: Merrill, 1977.

Hersen, M. & Barlow, D. H. Single Case Experiment Designs: Strategies for Studying Behavior Change. New York: Pergamon press, 1976.

LeBlanc, J. M., Reuter, K. E., Miller, D. N., & Schilnoeller, G. L. Laboratory investigations of applied behavior analysis techniques: Procedures designed to decrease or eliminate responding. In B. C. Etzel, J. M. LeBlanc, & D. M. Baer (Eds.) New Developments in Behavioral Research: Theory, Method and Application. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1977.

Leitenburg, H. The use of single-case methodology in psychotherapy research: Journal of Abnormal Psychology, 1973, 82, 87-101.

Lovaas, J. I., & Simmons, J. Q. Manipulation of self-destruction in three retarded children. Journal of Applied Behavior Analysis, 1969, 2, 143-157.

Lovaas, O. I., Schaeffer, B.; & Simmons, J. Q. Building social behavior in autistic children by use of electric shock. Journal of Experimental Research in Personality, 1965, 1, 99-109.

Martinez, S. S. Comparison of extinction, DRO 0-sec., and DRO 6-sec. in the elimination of imitative responding under discrete-trial paradigms. Journal of Applied Behavior Analysis, 1977, 10, 315.

Measel, C. J. & Alfieri, P. A. Treatment of self-injurious behavior by a combination of reinforcement for incompatible behavior and over-correction. American Journal of Mental Deficiency, 1976, 81, 147-153.

Mulhern, T. & Baumeister, A. A. An experimental attempt to reduce stereotype by reinforcement procedures. American Journal of Mental Deficiency, 1969, 74, 69-74.

Neisworth, J. T., Madle, R. A., & Golke, K. E. "Errorless" elimination of separation anxiety: A case study. Journal of Behavior Therapy and Experimental Psychiatry, 1975, 6, 79-82.

Poling, A., Miller, K., Nelson, N., & Ryan C. Reduction of undesired classroom behavior by systematically reinforcing the absence of such behavior. Education and Treatment of Children, 1978, 1, 35-41.

Ragain, R. D. & Anson, J. E. The control of self-mutilating behavior with positive reinforcement. Mental Retardation, 1976, 14, 22-25.

Repp, A. C. & Deitz, S. M. Reducing aggressive and self-injurious behavior of institutionalized retarded children through reinforcement of other behaviors. Journal of Applied Behavior Analysis, 1974, 7, 313-325.

Repp, A. C., Deitz, S.M. & Speir, N.C. Reducing stereotypic responding of retarded persons by the differential reinforcement of other behaviors. American Journal of Mental Deficiency, 1974, 79, 279-284.

Repp, A.C., Deitz, S.M., & Deitz, D.E. Reducing inappropriate behaviors in classrooms and in individual sessions through DRO schedules of reinforcement. Mental Retardation, 1976, 14, 11-15.

Repp, A.C. & Slack, D. J. Reducing responding of retarded persons by DRO schedules following a history of low-rate responding: A comparison of ascending interval sizes. Psychological Record, 1977, 3, 581-588.

Romanczk, R. & Goren, E. R. Severe self-injurious behavior: The problem of clinical control. Journal of Consulting and Clinical Psychology, 1975, 43, 730-739.

Rowbury, T., Baer, A.M., & Baer, D. Interactions between teacher guidance and contingent access to play in developing preacademic skills of deviant preschool children. Journal of Applied Behavior Analysis, 1976, 9, 85-104.

Skiba, E. A., Pettigrew, E. & Alden, S.E. A behavioral approach to the control of thumbsucking in the classroom. Journal of Applied Behavior Analysis, 1971, 4, 121-125.

Wallace, G. & Kauffman, J. M. Teaching children with learning problems. Charles Merrill: Columbus, Ohio, 1973.

Whitehead, W. E., Renault, P. F. & Goldiamond, I. Modification of human gastric acid secretion with operant-conditioning procedures. Journal of Applied Behavior Analysis, 1975, 8, 147-156.

Zeiler, M. D. Other behaviors: Consequences of reinforcing not responding. Journal of Psychology, 1970, 74, 149.

Zlutnick, S., Mayville, W. J., & Moffat, S. Modification of seizure disorders: the interruption of behavioral chains. Journal of Applied Behavior Analysis, 1975, 8, 1-12.

The Appropriate Use of Satiation-Negative Practice and Overcorrection Procedures

by

Mark S. Shepp
School Psychologist
Northern Trails Area Education Agency

Introduction

The topic to be covered in this paper is the use of two different but somewhat conceptually related techniques in reducing the maladaptive behaviors of children and young adults. The techniques are satiation/negative practice and over-correction. Historically, these are not new techniques of behavior change and have probably existed in the "common sense" behavior change repertoire for quite some time.

Satiation/negative practice was apparently used, according to family history, by this psychologist's grandfather to "cure" one of his offspring of smoking cigars. Treatment consisted of smoking five large Havanas one after the other until the contents of the stomach were emptied. From second-hand reports, treatment was quite effective initially but this psychologist personally has witnessed evidence pointing to problems in duration of treatment effect. In other words, the person in question smokes cigars to this day.

Overcorrection has existed in Jewish and Anglo-Saxon legal theory and practice for centuries. The component part of overcorrection that has been put to legal use is the concept of restitution. Legal concepts have tended towards and away from restitutional "justice" over the years (law and justice are separate entities). The farthest point away from justice perhaps was when the English courts imprisoned debtors until they could pay up their debts. Lately, a swing back towards restitutional justice has been noted in that juvenile judges are again making use of the concept of restitution. Cases in point would be youthful offenders paying for damages done or being responsible for repairing damages. Some magistrates have even more closely approximated the technique of restitutional overcorrection by ordering youthful offenders to not only make restitution for damages but also for putting things back in a condition somewhat improved from the original. It may be that in the future offenders will be sentenced to repetitive practice of appropriate behaviors which would approximate the positive practice component of overcorrection.

So much for the popular use of satiation/negative practice and overcorrection. The formalized or scientific application of these principles of behavior change has come about quite recently. Satiation/negative practice appeared in the literature for the first, and apparently only, time in 1963 in a study by Teodoro Allyon. Allyon did not research this technique in depth but later went on to become well known in researching the application of operant techniques to disruptive/hyperactive behavior in children. Overcorrection as a technique first appeared in the literature in 1972 in an article by Richard Foxx and Nathan Azrin. These two

workers have spent considerable time and effort researching the parameters of overcorrection and its application to various behavioral problems, developmental levels, and diagnostic groups. Foxx and Azrin are largely responsible for the formulation and validation of the technique of overcorrection.

This chapter includes a review of the pertinent literature, a discussion of the practical issues in applying the two methods including guidelines for appropriate application, illustrations of both methods from the author's experience, and a personal summary. The purpose of this paper is to explain the appropriate use of the techniques, arouse the reader's curiosity, and stimulate willingness to give the techniques a try, and instill in the reader a proper respect for the techniques' power, and the rights of the clients to whom they are applied.

Literature Review

The literature related to these two techniques is entirely of the applied behavioral analysis/singe subject design genre. This position does not focus on the need to use a homogenous group of subjects as part of an experimental design to wash out individual differences and enhance generalizations, or "external validity" (Campbell & Standley, 1963). This position does focus on the behavior of individuals, "...via many sequential observations rather than a few observations from many subjects." (Bailey & Bostow, ?, p. 23). The behavioral analysis position does not attempt to control experimental design in order to maximize generalizability of treatment effect, but views each treatment application as an independent piece of research in and of itself. The balance of the following review of the literature on the technique of overcorrection was drawn from a very helpful article published in Behavior Therapy in 1978 by Thomas Ollendick and Johnny Matson.

Ollendick and Matson correctly point out that two types of overcorrection have been described in the literature, restitutional overcorrection and positive practice overcorrection (Foxx & Azrin, 1973). Favell (1977, p. 139) defines restitutional overcorrection in terms of a misbehaving individual being required to "...(1) restore his environment to a state which is better than it was before his inappropriate behavior disrupted it..." In the same reference, Favell refers to positive practice overcorrection in terms of the misbehaving individual being required to "...(2) intensively practice appropriate alternative behavior."

Restitutional overcorrection, then, requires the disruptive individual to restore what was disrupted to a state much better than it was before the act. A good example of this would be a child who marks on a wall being required to not only erase the marks, but to clean the entire wall. In order to properly apply restitutional overcorrection, the behavior in question must have led to some disruption or change in the physical environment. When no environmental disruption or change is created by an

inappropriate act, restitutional overcorrection would not be applicable. Positive practice overcorrection involves requiring the individual in question to repeatedly practice a positive and proper alternative to the maladaptive behavior demonstrated. An example of this would be repeated practice of the appropriate use of a body part that is being used in self-stimulatory or self-injurious behavior.

According to Ollendick and Matson, the literature pertaining to the effectiveness of overcorrection centers around three general areas of problem behavior: self-stimulatory behavior, self-injurious behavior, and aggressive-disruptive behavior. Applications to self-stimulatory behavior will be examined first because, in this psychologist's experience, "self-stim" is the most perplexing, difficult to control, and most frequent referral problem in lower level functioning clients (i.e., severely and profoundly handicapped, and autistic individuals). Forehand & Baumeister (1976) cite estimates as high as 66% for the incidents of "self-stim" behavior in institutionalized, retarded, and autistic populations. Applications of overcorrection to "self-stim" behavior in children are described below.

Overcorrection and Self-Stimulatory Behavior

As would be expected, Foxx & Azrin (1973) were the first to apply overcorrection techniques to "self-stim" in retarded and autistic children. Here, "self-stim" behavior in three severely retarded children and one autistic-like child was attacked by using both restitutional and positive practice overcorrection. Restitutional overcorrection was employed for hand and object mouthing behaviors. The specific techniques applied consisted of making brushing teeth and gums with a bad tasting antiseptic solution and wiping the outer lips with a washcloth soaked in this solution for two minutes contingent on the inappropriate mouthing. Positive practice overcorrection consisted, at first, of manually guiding head and hands through a series of directed functional movements for five minutes. The manual prompts used were then quickly faded to a verbal warning.

For three of the four children involved, Foxx and Azrin reported significant decreases in maladaptive behavior. The child who showed a head weaving behavior responded to an increase in positive practice from five minutes to 20 minutes. More specifically, "The results showed that overcorrection procedures reduced self-stimulation substantially...and to a near zero level by the end of 10 days and sometimes sooner." (Foxx & Azrin, 1973, p. 12)

Many other references can be found attesting to the efficacy of both positive practice and restitutional overcorrection with self-stimulative behavior in children. The preponderance of "self-stim" studies have included positive practice overcorrection

since it is more conceptually applicable than restitution which demands an environmental disruption that can be put in better order than it was. Successful treatment is cited in the literature with positive practice overcorrection for such "self-stim" behaviors as excessive thumb sucking (Freeman, Moss, Somerset, & Ritvo, 1977), repetitive masturbation (Luiselli, Helfen, Pembarton, & Reisman, 1977), and repetitive hand and foot movements (Epstein, Doke, Sajwaj, Sorrell, and Rimmer, 1974). Client descriptive categories for the above articles included autistic children, mentally retarded, behaviorally disturbed, and schizophrenic children. Doke and Epstein (1975) report the use of restitutional overcorrection in the treatment of self-stimulatory hand mouthing in two behaviorally disordered children.

Self-stimulatory behavior in adults has also been subject to overcorrection treatment with somewhat less satisfying results than those achieved with children. Azrin, Kaplan, & Foxx (1973) successfully treated nine severely and profoundly retarded adults using positive practice overcorrection. Verbal warnings were still sufficient to control the behavior at a two month follow-up. rollings, baumeister, & Baumeister (1977) successfully treated one of two retarded adults with positive practice overcorrection. A six month follow-up revealed renewed "self-stim" in the adult who was successfully treated.

In summary, overcorrection procedures produced an immediate and durable treatment effect for self-stimulative behaviors in children and an immediate treatment effect in some adults. In the treatment of adults, some proved unresponsive and some successfully treated adults showed a regression to self-stimulatory behavior over time.

Overcorrection and Self-Injurious Behavior

Ollendick and Matson chose self-injurious behavior (SIB) as a descriptor for the second general area to which overcorrection procedures have been applied. SIB is somewhat lower in incidence than self-stimulatory behavior (7% in the normal pediatric population, 11% in institutionalized retarded individuals, 40% in schizophrenic children according to Baumeister & Rollings, 1976) but still no less a major concern, due to the considerable and irreversible tissue damage which can be its result, and its demoralizing psychological effect on both clients and staff.

The application of overcorrection technology to SIB in children has been attempted on several occasions. Positive practice overcorrection has been used by Freeman, Graham, & Ritvo (1975) to reduce nail picking by an aphasic child; by Harris and Romanczyk (1976) to reduce head and chin banking of a rubella syndrome child; by Kelly & Drabman (1977) to reduce eye poking in a visually handicapped child; and by Mesel & Alfieri (1976) to eliminate head banging and slapping in two profoundly retarded boys.

While the first three studies pointed to a successful treatment effect, the Mesel & Alfieri study showed improvement in one subject but an increase in the undesirable behavior in one boy which led to termination of the study. Barnard, Wolf, & Christophersen (in press) used parentally delivered restitutional overcorrection with four young children with head banging and hand biting SIB. Three of the four children showed drastic decreases in SIB, but one child with head banging SIB remained unchanged. Long term follow-up of the successfully treated children (almost two years) points to the maintenance of zero or near zero levels of SIB.

In the case of adult SIB, two studies involving Nathan Azrin (Webster & Azrin, 1973, and Azrin et.al., 1975) point to the generally successful use of positive practice overcorrection. In the 1973 Webster & Azrin study, forced relaxation was not immediately effective as a procedure but over time, it did reduce the SIB of the adult in question to a near zero level. The Azrin et.al. (1975) study compared two variants of positive practice overcorrection with 10 retarded adults and one schizophrenic adult. Six of the people received required relaxation and the other five received functional movement training. Both of these components are variations of practicing positive alternative appropriate behaviors. Three out of the six people showed improvements with required relaxation and, of the three that did not, functional movement training obtained successful results.

The support that can be found in the literature than for the application of overcorrection to SIB is favorable but not as strong as it is for the treatment of self-stimulatory behavior. For some of the individuals observed in the studies, the procedures were not at all effective, or delayed in effectiveness. The most hopeful note can be seen in its application to children (Barnard, Wolf, & Christophersen, in press) where treatment was quite effective, and apparently highly durable.

Overcorrection and Aggressive/Disruptive Behavior

The final general area Ollendick & Matson (1978) cover in their review of the effectiveness of overcorrection is aggressive/disruptive behavior. The frequency of this behavior for institutionalized persons is high (Forehand & Baumeister, 1976) and, from this psychologist's experience, can be very costly in terms of lost program time for the perpetrator, victim, and onlookers. The stress paid by staff and clients is also very costly.

According to Ollendick & Matson (1978), positive practice overcorrection was first applied to aggressive/disruptive behaviors in children in 1975 by Azrin & Powers. Azrin & Powers (1975) required six boys prone to disruptive behavior to practice correct procedures for talking in class and leaving one's seat, contingent upon talking out of turn or being out of seat without

permission. A reduction in disruptive behavior was noted and at follow-up the boys were no longer a problem to teachers. Ollendick and Matson, themselves, in 1976 used a combination of restitution and positive practice overcorrection with aggressive /disruptive behavior in two young children, using their mothers as the primary change agents. The restitutional part of the treatment consisted of requiring the children to apologize to and comfort the victim, and the positive practice component required the children to repeatedly practice alternative appropriate behaviors. The treatment was generally effective but, for one of the children, treatment had to be extended from five minutes to 10 minutes before it was effective.

Overcorrection with Adults

With adults, Foxx and Azrin (1973) first applied restitutional overcorrection to three aggressive/disruptive retarded adults. A sampling of the behaviors described in these adults included: throwing beds, chairs, and tables, biting, scratching, and screaming. Three minute duration restitutional overcorrection was used, requiring the offending individuals to restore the environment back to a state better than its original condition. All three adults evidenced a rapid drop in the frequency of the above mentioned behaviors, and apparently the treatment effects were also quite durable, although Ollendick & Matson's article cites no follow-up interval.

Sumner, Mueser, Hsu, and Morales (1974) applied restitutional overcorrection to female psychiatric inpatients with good results. They do note that time spent in restitution had to be increased in one patient in order to be effective. Positive practice overcorrection with aggressive/disruptive adults (required relaxation in every case) has been successfully used by the following clinicians for the following problems: Webster & Azrin (1973) -- tantrums, screaming, and physical assault; Azrin and Wesolowski (1975a, 1975b) — floor sprawling and vomiting.

In summary then, restitutional and positive practice overcorrection techniques have resulted in very quick and durable treatment effects in self-stimulatory behaviors in children. In adults, the results of treatment seem to be immediate but their durability is in question. The evidence in support of overcorrection with SIB is encouraging both for children and adults, but not as strong as it is for the treatment of self-stimulatory behavior. The evidence for the use of overcorrection in aggressive/disruptive behaviors is quite convincing for both children and adults. It should be noted that, in many cases where initial efforts were unsuccessful, a lengthening of the duration of treatment (positive practice or restitutional activities) served to greatly enhance the treatment effect and, in most cases, lowered the maladaptive response frequency to near zero.

Characteristics of Overcorrection

Ollendick and Matson used the literature reviewed in their article to ascertain the relative importance of the four characteristics of overcorrection, as described by Foxx and Azrin (1972). These four procedural characteristics are: the treatment is directly related topographically to the misbehavior, it should be applied immediately, it should be of extended duration, and the treatment should be actively and vigorously performed by the individual.

The first point, topographical relatedness, is closely related to the "educative" aim of overcorrection. While it does reduce maladaptive behaviors, it is also thought to "teach" appropriate alternative behaviors. A review of four related studies: Epstein et al (1974), Doke & Epstein (1975), Ollendick et al (in press), and Wells, et al (in press), points out that, while topographically dissimilar overcorrection can be effective in reducing inappropriate behavior, topographically similar overcorrection procedures may be more effective and more durable in treatment effect.

Only one study (Azrin & Powers, 1975) has addressed the issue of an overcorrection procedure being immediately contingent upon maladaptive behaviors. It does appear, on the basis of that one study involving a comparison of immediate and delayed conditions, that immediate delivery of overcorrection procedures is the desired condition in terms of treatment effectiveness.

Ollendick and Matson reviewed 23 studies regarding the effect of treatment duration and found no optimal interval across classes of behavior or client groups. On four occasions however, it was necessary to extend the duration of treatment in order to fully maximize the treatment effect and lower maladaptive behaviors to zero or near zero.

The active and vigorous performance (effort) condition of overcorrection described by Foxx & Azrin (1972) is thought to be of value by introducing an aversive component to training which would set up an avoidance paradigm focused on the maladaptive behavior in question. One question this psychologist did not find addressed is the impediment of this aversive component on the learning of more adaptive behaviors, specifically in the positive practice condition. Doesn't it follow that the aversive aspects of positive practice may impede the learning of adaptive alternatives which is a selling point of that technique? In any case, Ollendick and Matson's review of the literature found the beneficial treatment effects of overcorrection could be modeled by passive observers. Modeling was definitely present but the modeled reduction was not as immediately present or as durable as was the case when individuals actively and virorously went through the overcorrection procedure.

In summary then, the literature shows or partially substantiates that in order to be optimally effective, overcorrection procedures should be topographically similar to the maladaptive behavior in question, should be immediately contingent upon the maladaptive behavior, should be substantial in duration, and should be vigorously and actively carried out by the client.

Up to this point, the literature reviewed has emphasized the use of overcorrection techniques in reducing maladaptive behaviors. At least one study in the literature cited the use of overcorrection "avoidance," along with positive reinforcement to increase the amount of eye contact in retarded and autistic children. Foxx (1977) used a positive practice overcorrection procedure as an aversive consequence of nonattending, combining that with verbal praise and edibles for attending. This balanced intervention produced attention for 90% of trials attempted for two retarded and one autistic child subjects. This study points to the fact that the focus of an intervention should not be solely on reducing maladaptive behaviors but should include or even over-emphasize the strengthening of adaptive behaviors. Another important issue here is the importance of not expecting the "educative" aspects or properties of overcorrection to do the work automatically. The training in adaptive competing behaviors should always be emphasized in its own right.

The theoretical underpinnings of overcorrection, the discrete components of learning theory involved, and needed research regarding its effectiveness will be discussed next. Overcorrection is, according to Sulzer-Azaroff & Mayer (1977, p. 296), "...a specific type of mild punishment designed to minimize the negative reactions caused by intense punishment." As a punishment procedure, overcorrection can be seen as a stimulus which, when made contingent on a certain behavior, lowers the probability of that behavior's reoccurrence. This again brings up the issue of the "educative" nature of positive practice and restitutional overcorrection. Is it possible for appropriate alternative behaviors to be learned while they are concurrently thought to have the aversive effect of a punisher? Strange bedfellows, certainly! In any case, it is clear that the major effect of overcorrection techniques is to decrease maladaptive behavior. Appropriate and incompatible behaviors may be learned but it is the opinion of this writer that that specific learning had best be programmed for above and beyond what is provided in the overcorrection techniques.

As the reader may have been thinking, overcorrection would seem to be a label attached to a sequenced group of more simple but still discrete behavior change techniques. Forehand and Baumeister (1976) outline a number of these techniques, including extinction, time out from positive reinforcement, response prevention, physical restraint, prompting, reinforcement of competing responses, and alterations in the social environment.

No doubt all of these could be readily identified as components of overcorrection. In the opinion of this psychologist, the major functional components of overcorrection could include extinction or withdrawal of positive reinforcements for maladaptive behaviors, punishment contingent on maladaptive behavior, extended time out from positive reinforcement, rehearsal of and reward for competing adaptive behaviors, prompting and fading of prompts to verbal warning, and dependence upon cognitive mediation to develop an avoidance paradigm.

Research regarding the relative effectiveness of each one of the above mentioned components has yet to be carried out. What needs to be done is a series of "dismantling" studies, comparing the relative effectiveness of overcorrection's various components, and the parameters (i.e., duration) of these components, much the same as the work done in dismantling systematic desensitization in the late 1960's. Research of this type is sorely needed but generally rarely done.

Satiation/Negative Practice

We will next turn to a review of the literature regarding satiation/negative practice. As briefly touched on before, satiation/negative practice entails repeated practice to fatigue of an identified maladaptive behavior. Implied here is the principle of supplying a client with so much of a maladaptive behavior and its reinforcers that it is no longer potent or even interesting. The results of an Informs search of the literature came up with disappointingly few hints, one to be exact. In 1963 Allyon was faced with "towel stealing" behavior in an institutionalized psychotic woman. Allyon theorized that towels and their possession would no longer be reinforcing if the woman was supplied with large quantities of towels. In fact, what Allyon found was that as the number of towels given the woman increased, the behavior of hoarding and stealing towels decreased. The client in question actually began bringing towels back to the storeroom by herself and was soon stabilized at an appropriate number of towels. Allyon did use a positive component and provided the woman with a consumable reinforcer for appropriate quantity in possession and appropriate use of towels. to the best of this psychologist's knowledge, this is the only time the technique of satiation/negative practice has appeared in literature--a definite underemphasis for what seems to be a valuable technique.

The theoretical foundation of satiation/negative practice is simply that too much of a good thing is a bad thing. This can be traced back to the fatigue principle of autonomic nervous sytem functioning. A reliable reflex will cease to be reliable if stimulated to response too many consecutive times. After a reflex has been wiped out, a refractory time period needs to pass before the response is again reliable. This is analogous to operant behavior in that a reliable stimulus-response-reinforcement

consequence chain can be weakened and wiped out by simply engineering many consecutive occurrences of this chain. This is true of primary reinforcers (hunger-eating; thirst-drinking) and of secondary reinforcers (towels?) as is evidenced in the Allyon article. The theory itself puts several constraints on its use; with powerful reinforcers, satiation may be quite slow in occurring, behavior is only temporarily wiped out with satiation, and, while the response chain and reinforcement is being practiced to the point of satiation, other inappropriate behaviors could be inadvertently rewarded and strengthened.

In summary then, it could be said that satiation/negative practice is an under-researched technique. This writer has the feeling that it is not under used in practice, however, since informal conversations with many colleagues point to its frequent and successful use.

Practical Issues in Application

Building, then, on the aforementioned reviews of the literature concerning overcorrection and satiation/negative practice, we will next turn our attention to the mor practical aspects of the application of these two techniques given the resources and constraints of the environment in which the client exists. Included in this section are discussions of the benefits and limitations of the methods themselves, their proper place in a comprehensive and balanced behavior management system, how these techniques fit into a least to most restrictive concept of treatment, and finally ethical considerations in general, including using the ABAB treatment design.

Advantages of Overcorrection

The advantages of overcorrection are four in number, with the first being the most important from this writer's viewpoint. Overcorrection is a consequensive technique; that is, it is meant to be used as a consequence to maladaptive behavior in order to decrease its frequency. As a consequence, it is conceptually and logically related to the behavior it is to be made contingent upon, and there is a great deal to be said for that. It is the feeling of this psychologist that all too often we lose sight of the "reality" of the situation in which our clients exist. We design elaborate consequences for maladaptive behaviors (in effect punishers) but neglect to take full advantage of the natural or logical consequences connected to the behavior and readily available in the environment in which the maladaptive behavior occurs. It is always advisable to use logical or natural consequences where ever possible and to avoid, if at all possible, the use of contrived or unnatural consequences. Overcorrection

is naturally and logically related to the maladaptive behavior it consequences in that making restitution or practicing positive alternatives are both "common sense" ways of dealing with misbehavior. They require no contrived or unnatural consequences but only what would be common and naturally available in the environment. Another plus of the naturalness of overcorrection consequences is the enhancement of generalization and maintenance. These logical consequences can be appropriately used across all settings and can be easily faded to verbal prompts and then faded out. Consequences that are a logical product of a behavior and naturally available in the environment will be more easily learned, more readily generalized to other situations, and more easily faded to prompts and then out of the picture than will unnatural, contrived consequences.

A second advantage of overcorrection is that it minimizes the disadvantages of punishment. To quote Sultzer-Azaroff & Meyer, "Overcorrection appears less likely than intense punishment to produce excessive negative generalization, withdrawal, aggression, or negative self-comments. It is not a painful procedure nor does it provide an aggressive model." (1977, p. 297) Sultzer-Azaroff & Meyer do not specify if these side effects are present in the client or in the general public when it is revealed that punishment is being used with retarded individuals. In either case, it is clear that using overcorrection instead of punishment techniques does lower the probability of eliciting the above mentioned side effects.

Another advantage of overcorrection is its rapid and apparently long lasting effects. As was noted from the review of the literature on overcorrection, the evidence is convincing as far as its initial effectiveness and the durability of treatment effect.

The last advantage of overcorrection is that it intends to be educative; that is, to train in alternative adaptive behaviors. As was mentioned before in this article, "educative intent" is not enough and, if these adaptive behaviors are to be trained in, they had better be purposefully programmed for. This advantage is tied in closely with the second one mentioned above in that if the technique is educative and not just punitive, it will probably not elicit the side effects mentioned above from the general public.

Disadvantages of Overcorrection

The disadvantages of overcorrection are also four in number. The first disadvantage is that the procedure is still based on a limited number of studies that have not systematically explored the effectiveness of its component parts or its effectiveness with various developmental levels and diagnostic categories. Where we see in the literature that overcorrection has failed, or even made the situation worse, there needs to be an analysis of the reasons for failure and where they might lie; in the individual, in the procedure, or in the procedure's application?

A second disadvantage can be seen in the difficulty of keeping the positive practice overcorrection activity relevant to the maladaptive behavior. Since restitution is not applicable when the environment has not been disrupted, the activity needed to correct the disruption and improve on the original is usually quite obvious. However, there are some behaviors that do not disrupt the environment but are still quite difficult to conceptualize from a positive practice standpoint. A case in point might be where a client enjoys looking up ladies' dresses. What would be a related yet appropriate positive practice procedure for that behavior? In any case, it is evident that from a practical, ethical, and legal standpoint, overcorrection procedures should not be used if they are not related to the misbehavior and functionally appropriate. To quote Sultzer-Azaroff & Meyer, "This point is particularly important in light of Morales vs. Turman (1973), which declares that repetitive nonfunctional tasks lasting "many hours" constitute cruel and unusual punishment in violation of the Eighth Amendment of the Constitution." (1977, p. 301)

A third disadvantage of overcorrection is the investment of the individual attention of a staff member for an extended period of time. The cost effectiveness of this procedure must certainly be carefully analyzed in a time of shrinking budgets and staffs.

Finally, overcorrection is punishment and is an aversive procedure and as such should be used with extreme caution. It should be used within the limits of a least restrictive to most restrictive treatment philosophy, making sure that positive alternative procedures have been tried and found wanting before going to overcorrection.

Satiation/Negative Practice

The advantages of satiation/negative practice are somewhat similar to those of overcorrection. Although it is an aversive procedure, it is not considered intense in nature, largely due to its short duration. In most cases, five minutes of practice of the maladaptive behavior is enough to substantially lower the probability of its reoccurrence. Likewise, satiation/negative practice should not be used in isolation and only used in tandem with reinforcement for alternative adaptive behavior. It is the opinion of this psychologist that satiation/negative practice is most advantageously used in circumstances where the misbehavior is a direct result of the immediate effect it has on the environment. A prime example of this would be chronic slamming of doors for the "startle" effect it has on staff. Practice of door slamming for five minutes a day, along with a program including reinforcement for proper use of doors, has in this writer's experience proved most effective. With this procedure especially, it is important to keep the client's welfare and common sense foremost in the treatment team's decision-making process.

Requiring a client to practice the swallowing of sleeping pills for five minutes, contingent upon sleeping pill swallowing behavior, would not be appropriate. Satiation/negative practice then does have its advantages but demands a common sense approach with the client's welfare kept uppermost in mind.

The disadvantages of satiation/negative practice have mostly to do with its potential for abuse, such as the sleeping pill treatment mentioned above. Above all, the need for group decisions and common sense prvails. Other weaknesses of the technique are a limited (nonexistent) research base and again the fact that it is an aversive procedure and should be only used after positive approaches have been proven fruitless, and only then in combination with positive approaches and with extreme caution.

Guidelines for Technique Application

The next topic for discussion will be the use of both the techniques, not in isolation but within a balanced comprehensive behavior management system. It is the feeling of this psychologist that all methods aimed at decreasing maladaptive behavior, including positive practice overcorrection with its "educative" component, should be combined with a component designed to reinforce alternative or incompatible adaptive behaviors. No program should ever place more emphasis on the negative or deceleration component. At least equal, if not more emphasis, should be placed on accelerating alternative or incompatible adaptive behaviors. To quote a volume that still remains a classic, "The problem of deviant response substitution, however, can easily be forestalled by including in the original treatment program procedures that effectively remove the reinforcing conditions which sustain deviant behavior and concurrently foster desirable alternative modes of behavior." (Bandura 1969, pp. 51-52) In other words, if we do not design programs that actively program for training in alternative incompatible adaptive behaviors, we are asking for the old bugaboo of "symptom substitution."

Overcorrection does contain an educative component, but we should not assume that practicing positive behavior alternatives and restitutional behavior will do the job of adequately training in appropriate behaviors, especially since the practice in both cases is thought to also have an aversive effect. What needs to be done is to use a positive reinforcement technique (i.e., DRO, DRI) certainly on an intermittent basis to be delivered whenever appropriate behavior occurs outside of the overcorrection treatment. If the client does not have the skills to carry out appropriate alternative or incompatible behaviors, these skills

must be modeled or shaped into the individual's repertoire. If the client is being treated with satiation/negative practice, it is even more essential that a positive component be in place. In both instances, it is not enough to punish regardless of how mild it is or how it is camaflouged. If the clients are not concurrently "caught being good" and trained up in appropriate behaviors, it is quite probable that another deviant response will simply take the place of the one wiped out.

Several times throughout this paper the author has made reference to a least to most restrictive sequence of interventions. This is a very useful concept from the viewpoint of making sure that the client has had the opportunity to respond to a less restrictive treatment before attempting to go on to a more restrictive treatment. This would be analogous to the practice of attempting an aspirin and rest treatment for a cold before going on to a round of antibiotics. The reader will find a sample list of interventions below, going from least restrictive to most restrictive:

1. Placement of the child in a stimulating and enriched environment.
2. Simple extinction.
3. Differential reinforcement of other behavior (DRO).
4. Differential reinforcement of incompatible behavior (DRI).
5. Differential reinforcement of low rates (DRL).
6. Mild time out -- turning away.
7. Response cost.
8. Time out -- unlocked room.
*9. Satiation/negative practice.
*10. Overcorrection.
11. Time out -- locked room.
12. Medication.
13. Punishment with aversive stimuli.

As can be seen above, satiation/negative practice and overcorrection came towards the lower or more restrictive end of the list. The above list is not to imply that each item should be tried by itself before going on to the next. As the reader knows, punitive procedures should never be applied alone without a concurrent positive reinforcement component. Indeed, it is quite common to use many of the above listed techniques as different components within the same well balanced intervention plan. the list is supplied simply to give an idea of the relative restrictiveness of each technique. There exists certain behaviors, though, that, due to their seriousness, such as extreme SIB and the possibility for unalterable tissue damage, should be treated directly with a very restrictive/aversive intervention. In these cases, the time lag involved in attempting less restrictive treatments could lead to serious physical impairment, such as blindness in certain clients. These types of treatment decisions are not for one professional or even for a small group of professionals to make, as we shall see in the next section.

Ethical considerations in decisions regarding treatment are indispensable. It needs to be kept in mind that most of the clients to whom the two techniques in question would be applied would not be able to comprehend the rationale behind their use, much less effectively protest their use on humanitarian grounds. In this instance, we begin to look at the concept of "cost effectiveness" in a new way, not, is the outcome worthwhile in light of the staff time invested, but is the outcome worth the client's being subjected to aversive stimuli no matter how mild they may be. that is, is the client's discomfort worth the decrease in maladaptive behaviors? That judgment in some cases is not extremely difficult to make, such as in the case of SIB with extreme tissue damage. In other cases, however, such as self-stimulatory behavior, the factors to be weighed are not at all clear cut. This writer would not pretend to be capable of handing out hard and fast rules of when to apply and when not to apply the techniques. It is the opinion of this psychologist that in many, if not all, cases even the client's parents or guardians, and certainly not a team of professionals, should be totally responsible for the decision. This psychologist would opt for a cross-sectional committee from the community being made available to the treatment team for, if not final opinion of treatment decisions, at least consultation on difficult or ambiguous decisions.

The topic of ethical considerations also involves the type of treatment design used. The ABAB design when the behavior is allowed to return to baseline levels before it is finally wiped out is great for demonstrating experimental control but not so great from the standpoint of the staff or the client. this is particularly true in the case of aggressive/disruptive behavior and SIB. In nearly every case, this psychologist would not opt for a return to baseline to show control but would feel an ethical need to keep the intervention (if successful) in place until it is generalized and faded. If it is considered necessary to use a reversal to baseline design, perhaps it would be more ethically acceptable to stop treatment only until a definite trend upwards in the maladaptive behavior has been noted, and then to reinstate the treatment conditions.

Case Examples of the Application

Keeping in mind the prior discussions, the next section will focus on case examples of the application, successful and unsuccessful, of overcorrection and satiation/negative practice. The illustrations will not go into elaborate detail but will hopefully be explicit enough to give the reader a feel for the use of the techniques. The examples will all be drawn from the severe/profound population served by this psychologist because the opportunity to use overcorrection has not arisen in other populations presently being served.

The first example describes the unsuccessful treatment of a 14 year old severely and profoundly handicapped male who had been showing chronic SIB for at least three years. The SIB could be described as hitting himself very hard on the cheek and jaw and banging the bridge of his nose on objects sharp enough to cut the skin and cause bleeding and to leave visible scar tissue. No tissue damage was observable on the boy's jaw or on the inside of his mouth but what appeared to be a callous was forming on his gum. When this psychologist became involved, the daily frequency counts consistently ranged about 100 and sometimes reached as high as 200 discrete incidences of SIB. A contingency analysis revealed that this behavior was quite obviously attention and escape related in that the SIB was most likely to occur when one-to-one attention was about to be terminated and when academic demands were made on the client. Less restrictive interventions had already been unsuccessfully attempted, so the treatment team decided to go to a trial positive practice overcorrection. Functional arm movement (half of a jumping jack) was made contingent on SIB requiring five minutes duration with 30 seconds spent at each of three positions. Concurrently a program was run delivering consumable reinforcers and verbal praise for periods of no SIB and for successfully completing tasks and terminating one-to-one attention time without SIB. The results were disappointing and point to a weakness of overcorrection's application to clients to whom any kind of one-to-one attention is reinforcing. In this case, one-to-one functional arm movement was not noxious enough even at 10 minutes duration to become aversive. What the team perceived as an aversive stimulus was reinforcing to the client, and he actually increased the frequency counts of SIB in order to get the reinforcing functional movement training. In some instances, the client actually walked up to staff and prompted them to guide him through the training procedures. Some fun! The procedure was terminated and it was decided to go to a more restrictive/aversive concept, along with a psychiatric medication consult; at this point in time frequency counts have dropped to the 20's.

A successful example of the use of restitutional overcorrection with inappropriate mouthing behaviors follows. The client was a seven year old nonverbal severely profoundly handicapped female showing inappropriate mouthing behaviors. Developmentally, this girl was just at the one and one-half year level in most areas, and this would still be within the developmentally appropriate range for mouthing behavior. However, in light of her chronological age and the danger presented by her tendency to mouth while still being quite mobile, it was decided that a decrease in mouthing behavior would be an appropriate intervention. Baseline was taken during an hour of sand play designed for sensory stimulation purposes. The average per hour of inappropriate mouthings of tools, sand, etc., was found to be 12. The treatment parallels a treatment for mouthing attributable to Foxx

and Azrin (1973) and consisted of a firm "No" when inappropriate mouthing occurred and a contingent tooth brushing with a bad tasting oral antiseptic along with wiping the outer lips with a washcloth dampened by the same substance. The duration was two minutes in each case. The positive component of the program consisted of the use of praise and edible reinforcers ("You can eat this!") for nonmouthing behaviors and incompatible work behaviors during the same hour interval and throughout the day. One week later the frequency count had fallen to seven and continued falling to a nearly zero level. Follow-up procedures will include a widening of the interval to include the whole school day and cottage time.

As mentioned previously, satiation/negative practice is perhaps most effectively used in instances when the reinforcement for maladaptive behavior is the immediate result (i.e., a startled staff member) of its effect on the environment. In this case, the maladaptive behavior was door slamming in a seven year old severely profoundly handicapped female who seemed to enjoy the startle effect on both staff and other students. The treatment team saw this behavior as an appropriate intervention target because of its unnerving effect on both staff and children alike, along with its general inappropriateness in everyday life. The program entailed each door slam being consequenced by removal to a hall bathroom and five minutes of required door slamming. The team was prepared to up the ante to 10 minutes of program, if necessary, but this did not prove to be the case. The positive component of the intervention involved was verbal praise and hugs for appropriate door use. The frequency of door slams fell like the proverbial rock and has remained at zero for the better part of a year.

As can be seen from the above examples, overcorrection can be an effective behavior change technique. Frankly, at the beginning of this year, neither overcorrection nor satiation/negative practice were often used parts of this psychologist's technical repertoire. Jeff's invitation to participate in this project was the impetus to research and begin to use both techniques. Actually, it was a bit of a wrench in mind-set to concentrate totally on punitive deceleration techniques for the majority of this paper. In practice, the author attempts always to begin with and emphasize positive accelerative techniques and move on to punitive techniques only after the positive techniques have proved not to be potent enough. However, as we all know, it would be "Pollyannaish" to feel that punitive procedures were never necessary to use in a child's best interest. Both overcorrection and satiation/negative practice have proven to be effective and mild punitive procedures, when properly combined with appropriate positive reinforcers or "catch-em being good," techniques. No one technique is a panacea, of course, and all must be used with a common sense cost effective (for staff and client) approach.

If the reader of this paper comes away with one lasting idea, the author hopes that it is the concept of a balanced approach to behavioral programming. Use punitive procedures with proper safeguards and permission, if necessary, but don't forget the most common sensical and cost effective technique of all -- "Catch them while they're being good."

References

Allyon, T. Intensive treatment of psychotic behavior by stimulus satiation in food reinforcement. Behavior Research and Therapy, 1963, 1, 53-61.

Azrin, N. H., Gottlieb, L., Hughart, L., Wesolowski, M.D., & Rahn, T. Eliminating self-injurious behavior by educative procedures. Behavior Research and Therapy, 1975, 13, 101-111.

Azrin, N. H., Kaplan, S. J., & Foxx, R. M. Autism reversal: Eliminating sterotyped self-stimulation of retarded individuals. American Journal of Mental Deficiency, 1973, 78, 241-248.

Azrin, N. H., & Powers, M. A. Eliminating classroom disturbances of emotionally disturbed children by positive practice procedures. Behavior Therapy, 1975, 6, 525-534.

Azrin, N. H., & Wesolowski, M. D. Eliminating habitual vomiting in a retarded adult by positive practice and self-correction. Journal of Behavior Therapy and Experimental Psychiatry, 1975, 6, 145-148. (a)

Azrin, N. H., & Wesolowski, M. D. the use of positive practice to eliminate persistent floor sprawling by profoundly retarded persons. Behavior Therapy, 1975, 6, 617-631. (b)

Bailey, J. S., & Bostow, D. E. Research methods in applied behavior analysis. Tallahassee, Florida: Copy Grafix, ?.

Bandura, A. Principles of behavior modification. New York: Holt Rinehart & Winston, Inc., 1969.

Barnard, J. D., Wolf, M. M., & Christopherson, E. R. Training parents to treat self-injurious behaviors using overcorrection procedures: Outcome and follow-up. Pediatric Psychology, in press.

Baumeister, A. A., & Rollings, J. P. Self-injurious behavior. In N. R. Ellis (Ed.), International review of research in mental retardation, New York: Academic Press, 1976.

Campbell, D. D., & Standley, J. C. Experimental and Quasi-experimental designs for research. Chicago: Rand McNally Publishing Co., 1963.

Doke, L. A., & Epstein, L. H. Oral overcorrection: Side effects and extended applications. Journal of Experimental Child Psychology, 1975, 20, 496-511.

Epstein, L. H., Doke, L. A.; Sajwaj, T. E., Sorrell, S., & Rimmer, B. Generality and side effects of overcorrection. Journal of Applied Behavior Analysis, 1974, 7, 385-390.

Favell, J. E. The power of positive reinforcement: Handbook of behavior modification. Springfield, Ill. Charles C. Thomas, 1977/

Forehand, R.; & Baumeister, A. A. Decelerating aberrant behavior among retarded individuals. In M. Hersen, R. M. Eisler, & P. M. Miller (Eds.), Progress in behavior modification, New York: Academic Press, 1976.

Foxx, R. M. Attention training: The use of overcorrection avoidance to increase the eye contact of autistic and retarded children. Journal of Applied Behavior Analysis, 1977, 10, 489-499.

Foxx, R. M. & Azrin, N. H. Restitution: A method of eliminating aggressive-disruptive behaviors of retarded and brain damaged patients. Behavior Research & Therapy, 1972, 10, 15-27.

Foxx, R. M. & Azrin, N. H. The elimination of autistic self-stimulatory behavior by overcorrection. Journal of Applied Behavior Analysis, 1973, 6, 1-14.

Freeman, B. J., Graham, V., & Ritvo, E. R. Reduction of self-destructive behavior by overcorrection. Psychological Reports, 1975, 37, 446.

Freeman, B. J., Moss, D., Somerset, T., & Ritvo, E. R. Thumbsucking in an autistic child overcome by overcorrection. Journal of Behavior Therapy and Experimental Psychiatry, 1977, 8, 211-212.

Harris, S. L., & Romanczyk, R. G. Treating self-injurious behavior of a retarded child by overcorrection. Behavior Therapy, 1976, 7, 235-239.

Kelly, J. A., & Drabman, R. S. Generalizing response suppression of self-injurious behavior through an overcorrection punishment procedure. Behavior Therapy, 1977, 8, 468-472.

Luiselli, J. K., Helfen, C. S., Pemberton, B. M., & Reisman, J. The elimination of a child's in-class masturbation by overcorrection and reinforcement. Journal of Behavior Therapy and Experimental Psychiatry, 1977, 8, 201-204.

Measel, C. J.; & Alfieri, P. A. Treatment of self-injurious behavior by a combination of reinforcement for incompatible behavior and overcorrection. American Journal of Mental Deficiency, 1976, 81, 147-153.

Morales, V. Turman, 364F. Supp. 166 (E.D. Tex. 1973).

Ollendick, T. H., & Matson, J. L. An initial investigation into the parameters of overcorrection. Psychological Reports, 1976, 39, 1139-1142.

Ollendick, T. H., & Matson, J. L. Overcorrection: An overview. Behavior Therapy, 1978, 9, 830-842.

Ollendick, T. H.; & Matson, J. L., & Martin, J. E. Effectiveness of hand overcorrection for topographically similar and dissimilar self-stimulatory behaviors. Journal of Experimental Child Psychology, in press.

Rollings, J. P., Baumeister, A. A., & Baumeister, A. A. The use of overcorrection procedures to eliminate the stereotyped behaviors of retarded individuals: An analysis of collateral behaviors and generalization of suppressive effects. Behavior Modification. 1977, 1, 29-46.

Sulzer-Azaroff, D.; Mayer, G. R. Applying behavior analysis procedures with children and youth. New York: Holt, Rinehart, & Winston, 1977.

Sumner, J. G., Meuser, S. T., Hsu, L., & Morales, R. G. Overcorrection treatment for radical reduction of aggressive-disruptive behavior in institutionalized mental patients. Psychological Reports, 1974, 35, 655-662.

Webster, D. R., & Azrin, N. H. Required relaxation: A method of inhibiting agitative-disruptive behavior of retardates. Behavior Research and Therapy, 1973, 11, 67-78.

Wells, K. C., Forehand, R., Hickey, K., & Green, K. D. Effects of a procedure derived from the overcorrection principle on manipulated and nonmanipulated behaviors. Journal of Applied Behavior Analysis, in press.

Timeout:

Guidelines for the School Psychologist

by
Joe Meyers
Heartland Area Education Agency

Introduction

School psychologists have found over the past decade increasing demands for their service to the teachers and children they serve. No longer is the school psychologist just required to provide assessment services for the primary purpose of placing handicapped children into special education programs. It has been well documented that every child with a problem does not belong in a special education program. It has also been recognized that special classroom teachers need additional assistance in working with handicapped children other than knowing the intellectual level of students in their classrooms. School psychologists today recognize this need by teachers and are now providing many support services that have not been provided in the past.

A variety of remediation strategies have been well documented in the literature. Both positive reinforcement and punishment techniques have been applied in home and school settings with many favorable results. To review here many of the basic treatment strategies that improve child performance would only convince the reader that we have discovered the "atom" and that our discoveries are unique and different. The focus of this article on timeout is not to rediscover the "atom" but to review relevant information on the appropriate use of this very powerful treatment strategy.

Timeout from positive reinforcement as an acceptable therapeutic procedure has gained wide spread acceptance in many home and school classrooms today. Timeout procedures are being effective in suppressing a wide range of inappropriate behaviors. Timeout has been used extensively to decrease tantrums, shouting, and hitting in a home setting (Hawkins, Peterson, Schwied, and Bijou, 1966); thumbsucking (Baer, 1962); throwing of eyeglasses (Wolf, Ristey, and Mees, 1964); misbehavior in delinquents during recreation period (Tyler and Brown, 1967); crying temper tantrums, and inappropriate vocabulizations in speech training (Risley and Wolf, 1967); incorrect response in speech training (Sloane, Johnsen, and Harris, 1968); aggression and yelling (Bostour and Bailey, 1969); non-compliance to parent requests (Wahler, 1969a; Zielberger, Samper, and Sloane, 1968); home and school dirsuplive responses (Wahler, 1969b; Webster, 1976); and inappropriate behavior at meal time (Barton, Guess, Garcia and Baer, 1970).

Operationally defined, timeout means the contingent withdrawal (usually for a short period of time) of a reinforcing stimuli thought to be supporting the behavior of concern (Johnston, 1972). Functionally, timeout from positive reinforcement results in a decrease in the frequency of the reinforced behavior. Although it may be difficult at times to adequately define timeout with a single set of operatives, Baron, Kaufman, and Rakauskas (1967) have identified four response-contingent timeout strategies: (a)

removal of materials, (b) reduction or elimination of room illumination, (c) removal of adult attention, and (d) removal of the student from a potentially reinforcing situation. The first two of these strategies may be considered mildly punishing. The latter two strategies, which will be the focus of this paper, involve the withdrawal of powerful social reinforcers.

Timeout Considerations

MacDonough and forehand (1973) have identified several unique parameters that need to be considered by the psychologist when working with teachers prior to starting a timeout contingency. An overview of these issues is presented below.

1. A verbal explanation why a student is going to timeout needs to be considered. Few studies report any discussion of this step in the timeout process. In one study by Alvivizos and Alevizos (1972), the authors compared giving and not giving a reason before implementing timeout for four retarded students in a special education classroom. Results indicated that a verbal explanation did not decrease the effectiveness of timeout. While this may appear to be reasonable, it should be remembered that timeout is an extinction procedure with the primary purpose of removing all potentially reinforcing stimuli. With other students this simple adult attention may actually increase inappropriate behavior and decrease the effectiveness of the entire timeout procedure. Careful monitoring of the students behavior may be helpful and encouraged in evaluating the impact of a verbal explanation by the teacher.

2. A warning signal to the student that timeout is imminent may be helpful to both the student and the teacher. Although the research of the effects of a warning signal vary (Kendall de al., 1975; Wasek, Senn, Welch, and Cooper, 1969; Zeilberger, Sampen, and Sloan, 1968), the appropriateness of this process may avoid needless disruption in the classroom activities while at the same time assisting the student to consider what might be inappropriate. If a warning is to be employed it should be explicit, brief, and not direct undue attention to the student. If, however, the teacher observes an increase in her warnings, the procedure should be dropped.

3. The administration of timeout may be simply instructing the student to go to timeout or physically removing him to the timeout area. Whenever possible the verbal instruction is preferred and requires less disruption to the classroom routine. This method also places more responsibility for self control on the student which may not always be possible for severe M.D. or E.D. students. The actual method of administering timeout will depend greatly on the age of the child, setting, and the severity of the disability.

4. The location of timeout may depend on the flexibility of the teacher and the physical facility. May, McAllister, Risley, Twardosy, and Cox (1974) identified three types of enviroments in which timeout could be taken.

The first involves observational timeout in which the student is removed from the activity, placed in a chair near the activity, and observes the appropriate behavior of his peers. This gives the teacher the opportunity to deliberately attend to those students who are displaying appropriate behavior. If the student continues to engage in inappropriate behavior, exclusion timeout should be considered.

Exclusion timeout is similar to the previous timeout procedure with the exception that the student does not have the opportunity to observe appropriate behavior of his peers. This involves a much higher response cost to the teacher by disrupting the teaching activity to remove the student to another part of the room.

Seclusion timeout is the most adversive and the most frequently used timeout procedure (Bostow and Bailey, 1962; Clark, Rowbury, Baer, and Baer, 1973; Pendergrass, 1972). This is often referred as the "timeout room." Often the procedures require the teacher to physically remove the child from the classroom into an isolated room. Seclusion timeout is generally employed with very severe disruptive behavior found in special education programs or in home settings. The effect can be very powerful at decreasing inappropriate behavior but it can also be abused.

The amount of time spent in timeout has seldom been addressed in the research. Students sent into timeout have ranged from two minutes (Bostow and Bailey, 1969) to as long as three hours (Burchard and Tyler, 1965). Extensive periods of timeout should be carefully considered because of possible ethical and legal concerns. It should be emphasized here that timeout is used to remove the student from a positively reinforcing stimuli, not to present adversive stimuli.

White, Nielson, and Johnson (1972) studied the effect of three different timeout durations with a group of 20 retarded, institutionalized subjects. Employing a counter balanced design in which all the subjects were exposed to 1, 15, and 30 minute timeout periods in different sequences, the investigators found the one minute duration was as effective as the 15 and 30 minute durations if the one minute duration occurred first in the sequence. If, however, the one minute timeout duration followed the 15 or 30 minute timeout duration the one minute timeout had no effect. The authors recommended the use of shorter timeout durations if longer timeout durations have not been used in the past. Patterson and white (1969) have found that a majority of investigators reporting timeout durations in the range of 5 to

20 minutes. A general rule of thumb that should be followed is to start off with short timeout durations, measure its effect of the behavior, and increase if needed.

One can signal to a student the beginning and/or end of timeout with a nonverbal stimuli (pointing response). This technique causes little disruption to the classroom routine and enhances the students self control. This technique may prove to be particularly applicable for a student not in exclusion or seclusion timeout.

Very little has been done in comparing the effects of continuous and intermitent schedules of timeout to suppress inappropriate behavior. A fundamental principal of human behavior is that consistent consequences for emitting a specified behavior initially bring that behavior under stimulus control. Therefore, a continuous schedule of reinforcement maximizes the probability that appropriate behavior will increase in frequency. One can only assume that with the systematic application of timeout for inappropriate behavior will increase the probability that the rate of disruptive behavior will decrease.

Lastly, it is important to describe to the student the requirements for release from timeout. Appropriate behavior should be observed during timeout before the student is released. If not, timeout may become a reinforcing contingency for the student with no effect on the deviant behavior that sent him into timeout.

In summary, when considering the use of a timeout procedure, the psychologist should consider if a verbal explanation is to be provided, whether a warning signal is to be provided, the administration of timeout, the location in which timeout is to be taken, the amount of time to be spent in timeout, and use of non-verbal signal to direct a student in or out of timeout, and under what conditions the student should be released from timeout. Each of these factors may have a significant impact of the success or failure of a timeout procedure. The school psychologist needs to seriously consider these factors when assisting a classroom teacher.

Practical Guidelines for Using Timeout

Before implementing a timeout procedure, guidelines should be established to avoid pitfalls that may develop from within or outside the school setting. These guidelines should be systematically planned, carefully supervised by the psychologist and teacher, and continously evaluated over time. Gast and Nelson (1977) have recommended that the following 10 guidelines should be followed when developing and implementing a timeout program.

1. Staff should be able to identify the reinforcing situations that are maintaining the child's inappropriate behavior.

2. Those behaviors that will result in timeout should be explicitly stated before the timeout contingency is implemented.

3. The teacher should attempt to control the inappropriate behavior first by employing milder forms of timeout (i.e., ignoring, contingent observation, and exclusion timeout, respectively) prior to resorting to seclusion timeout.

4. Documentation that milder forms of timeout have proved ineffective in suppressing the inappropriate behavior should be provided before resorting to seclusion timeout.

5. The teacher should formulate a concise, written statement of procedures to be followed whenever placing a student in timeout. The authors suggest these specific practices.

   a. Avoid lengthy verbal explanations as to why the student is being placed in timeout. Behaviors resulting in timeout should be clearly explained prior to implementing the timeout program. If an explanation is provided, it should be brief but should adequately inform the student of the misbehavior involved. A standard explanation format such as, "Because you go to timeout for ____ minutes," is recommended. All other interaction should be avoided.

   b. Identify those behaviors, if any, that will result in a warning before timout is implemented. These generally are behaviors of low frequency and magnitude that have not been defined explicitly previously. (Other behavior normally will require no warning.)

   c. To maximize opportunities to exercise self control, students should be given the opportunity to take their own timeout after receiving the instruction from the teacher. However, if students refuse to take their own timeout or if they fail to respond to the teacher's instruction within a reasonable time interval (5 to 10 seconds), the teacher should physically remove them to the timeout area. For high intensity behavior (e.g., kicking, screaming), the student should be immediately escorted to timeout. It is important that teachers realistically evaluate their ability to physically remove a child to the timeout area. If a pupil is able to "break away," requiring a teacher to physically remove the student would be inappropriate. Presumably, classrooms with such students would either have a teacher or teacher aide who could control such resistance. If such is not the case, an alternative strategy will be required. This may entail a reevaluation of the reinforcers in the classroom and the possible use of a response cost contingency in conjunction with a token economy. Other alternatives may

include reinforcing other children for ignoring disruptive behaviors or the reassignment of the uncontrolable student to a teacher who is capable of managing highly aggressive and resistant behavior.

d. The duration of each timeout period should be brief. One to five minutes generally is sufficient. It is doubtful that timeout periods exceeding 15 minutes serve the purpose for which they are intended (i.e., temporary withholding of positive reinforcement).

e. Release from timeout should be made contingent upon the student's behavir while in timeout. A changeover delay procedure of 1 minute (i.e., a contingency for release from timeout of 1 minute in which no inappropriate responses are emitted) will avoid reinforcing a child's inappropriate behavior while in timeout.

6. If a seclusion timeout is to be employed, the timeout room should:

   a. Be at least six by six feet in size.
   b. Be properly lighted (preferably recessed, with the switch outside the room).
   c. Be properly ventilated.
   d. Be free of objects and fixtures with which children could harm themselves.
   e. Provide the means by which an adult could continously monitor, visually and auditorily, the student's behavior.
   f. Not be locked. A latch on the door should be used only as needed, and only with careful monitoring.

7. Records should be kept of each occasion when timeout is implemented and should include the following information:

   a. The student's name.
   b. The episode resulting in student's placement in timeout (i.e., behavior, activity, other students involved, staff person).
   c. The time of day student was placed in timeout.
   d. The time of day student was released from timeout.
   e. The total time in timeout.
   f. The type of timeout (contingent observation, exclusion, or seclusion).
   g. The student's behavior in timeout.

8. Differential reinforcement of more appropriate social behavior (DRO) should always accompany a timeout contingency.

9. For timeout durations in excess of 30 minutes, a supervisory staff person should be consulted to evaluate the appropriateness of continuing the timeout procedure.

10. An advisory committee, consisting of the teacher, principal, behavior specialist (school psychologist), and parent should be called to evaluate the appropriateness of using timeout as a consequence for misbehavior if its effect in suppressing the behavior is questionable.

As can easily be noted here, timeout is not just a simple procedure of removing a student from the classroom. A well thought plan of the impact and process of a timeout procedure needs to be a high priority to the school psychologist. If not, the timeout procedure can be expected to fail.

Conclusions

It should be understood after this review of timeout that the classroom must be a reinforcing environment. If not, timeout will most likely fail to the frustration of both the school psychologist and teacher. One needs to remember that timeout should not be the only remediation strategy used in the classroom. Timeout interventions represent only one procedure of a broad range of procedures that a teacher could use when attempting to decrease inappropriate behavior or increase appropriate behavior in the classroom. Ignoring other intervention strategies will often reduce the effectiveness of timeout and lead to possible abuse of the procedure.

It should be remembered that the ultimate goal of timeout is to improve the self control of the child. By applying the guidelines sytematically and judiciously, the teacher can provide many opportunities for the internalization of self control. The appropriate application of timeout in addition to positive reinforcement strategies should maximize the development of the child to his fullest potential.

References

Alevizos, K. J. and Alevizos, P. N. The Role of Verbalizing and Not Verbalizing Timeout Contingencies in a Therapy Classroom. paper presented at the Western Psychological Association, Portland, Oregon, 1972.

Baer, D. M. Laboratory control of thumbsucking by withdrawal and re-presentation of reinforcement. Journal of the Experimental Analysis of Behavior, 1962, 5, 525-528.

Baron, A., Kaufman, A., and Rakauskas, I. Ineffectiveness of "timeout" punishment in suppressing human operant behavior. Psychomonic Science, 1967, 8, 329-330.

Barton, E. S., Guess, D., Garcia, E., and Baer, D. M. Improvement of retardates' mealtime behaviors by timeout procedures using multiple baseline techniques. Journal of Applied Behavior Analysis, 1970, 3, 77-84.

Bostow, D. E. and Bailey, J. B. Modification of severe disruptive and aggressive behavior using brief timeout and reinforcement procedures. Journal of Applied Behavior Analysis, 1969, 2, 31-37.

Burchard, J., and Tyler V., Jr. The modification of delinquent behavior through operant conditioning. Behavior Research and Therapy, 1965, 2, 245-250.

Clark, H., Rowbury, T., Baer, A., and Baer, D. Timeout as a punishing stimulus in continuous and intermittent schedules. Journal of Applied Behavior Analysis, 1973, 6, 443-455.

Gast, D. L., and Nelson, C. M. Time Out in the Classroom: Implications for Special Education. Exceptional Children, 1977, 43, 462-464.

Hawkins, R. P., Peterson, R. F., Schewid, E., and Bijou, S.W. Behavior therapy in the home: Amelioration of problem parent child relations with the parent in a therapeutic role. Journal of Experimental Child Psychology, 1966, 4, 99-107.

Johnson, J. M. Punishment of human behavior. American Psychologist, 1972, 27, 1033-1054.

Kendall, P. C., Nay, W. R., and Jeffers, J. Timeout duration and contrast effects: A systematic evaluation of a successive treatment design. Behavior Therapy, 1975, 6, 609-615.

MacDonough, T. S., and Forehand, R. Response-contingent timeout: Important parameters in behavior modification with children. Journal of Behavior Therapy and Experimental Psychiatry, 1973, 4, 231-236.

May, J. G., McAllister, J., Risley, T., Twardosz, S., and Cox, C. H. Florida guidelines for the use of behavioral procedures in the state programs for the retarded. Florida Division of Retardation, 1974.

Patterson, G. R., and White, G. D. It's a small world: The application of "timeout from positive reinforcement." Oregon Psychological Association Newslettter, 1969, 15, No. 2, Supplement.

Pendergrass, V. E. Timeout from positive reinforcement following persistent high rate behavior of retardates. Journal of Applied Behavior Analysis, 1972, 5, 85-91.

Risley, T. R. and Wolf, M. M. Establishing functional speech in echolalic children. Behavior Research and Therapy, 1967, 5, 73-88.

Sloane, H. N., Jr., Johnson, M., and Harris, F. R. Remedial procedures for teaching verbal behavior to speech deficiant or defective young children. In H. N. Sloane Jr., and B. MacAulay (Eds.). Operant procedures in remedial speech and language training. Boston, Mass.: Houghton Mifflin, 1968, Pp. 77-101.

Wahler, R. G. Oppositional children: A quest for parental reinforcement control. Journal of Applied Behavior Analysis, 1969, 2, 159-170. (a)

Wahler, R. G. Setting generality: some specific and general effects of child behavior therapy. Journal of Applied Behavior Analysis, 1969, 2, 239-246. (b)

Tyler, V. O. and Brown, G. D. The use of swift, brief, isolation as a group control device for institutionalized delinquents. Behavior Research and Therapy, 1967, 5, 1-9.

Webster, R. E. A Timeout Procedure in a Public School Setting. Psychology in the Schools, 1976, 13, 72-76.

White, G. D., Nielson, G., and Johnson, S. M. Timeout duration and the suppression of deviant behavior in children. Journal of Applied Behavior Analysis, 1972, 5, 111-120.

Wolf, M. M., Risley, T. R., and Mees, H. Application of operant conditioning procedures to the behavior problems of an autistic child. Behavior Research and Therapy, 1974, 1, 305-332.

Zeilberger, J., Sampen, S. E., and Sloane, H. N. Modification of a child's problem behaviors in the home with the mother as therapist. Journal of Applied Behavior Analysis, 1968, 1, 47-53.

Punishment

by

Phil Duncan
Drake University

Introduction

The term "punishment" is not new to most people, but the use of the term in behavior modification is quite different from its colloquial use. Webster's New World Dictionary, College Edition, (1964) defines the verb punish: "1. to cause (a person) to undergo pain, loss, or suffering for crime or wrongdoing. 2. to impose a penalty on a criminal or wrongdoer for (an offense)" (p. 1180). These definitions provide a common cultural basis for the notion that punishment involves unpleasantness for the recipient because of some "offense". Clearly the emphasis is on the delivery of some noxious event.

Behavior modification literature, on the other hand, provides a rather different statement about what constitutes punishment. Catania (1979) suggests that "...punishment is arranging a consequence of responding that reduces the likelihood of the response" (p. 93). Azrin and Holz (1966) provide a similar definition: "...punishment is a reduction of the future probability of a specific response as a result of the immediate delivery of a stimulus for that response" (p. 381). Similar to Webster's definitions, these behavioral definitions involve the occurrence of consequences for a person's actions. The clear and critical difference, however, is that in behavior modification, punishment is defined in terms of its effect on a specific behavior (response) of the recipient. Whether the consequence produced by a response is pleasant or unpleasant is irrelevant; the reduction of response probability in the future is the key element.

The behavioral view of punishment as a procedure which decreases or eliminates behavior is consistent with the role natural events can play in altering behavior. A casual look at nature provides many examples of punishment. The consequence of pinched fingers teaches the young child how not to close a door; reaching for the pretty flames of a fire occurs infrequently, if ever, after a burn occurs. Consuming too much root beer may, through a tummy ache, reduce both the consumption and enthusiasm (at least temporarily) for the drink.

It is important to note that punishment plays a key role in the health and/or survival of the individual. Broken or dysfunctional limbs could easily result from the non-punished, unrestrained activities of individuals, especially children. Thus, in a natural order of events, punishment is nature's way of telling us to behave differently.

It is also useful to point out here that nature does not bear "grudges". As soon as the child removes his fingers from the door, the pinching stops. The dangerous reaching response, not the child, has been punished, and natural events remain available

immediately as reinforcers for appropriate behavior. The importance of combining conservative, restricted punishment procedures with liberal, specific reinforcement procedures is an important lesson to learn from nature. Many parents and teachers would do well to study this lesson.

It should be clear, then, that punishment is a phenomenon not invented by behavior modifiers, but descriptive of the relationship between particular behaviors and the environmental events which follow them. Many researchers have investigated the complexities of punishment, and the remainder of this chapter briefly presents the highlights of that research, and the implications for applying punishment in the home and school.

Brief Historical Review

As with many phenomena involving the behavior of humans, punishment research began in the animal laboratory. E. L. Thorndike (1898) reported one of the earliest demonstrations of punishment and reinforcement using cats as experimental subjects. A hungry cat was confined to a small "puzzle box" from which it could escape by tripping a latch with its paw. Escape allowed the cat to consume a small amount of fish. Thorndike pointed out that many responses which a cat made while trying to escape were not successful, leading to prolonged confinement, prolonged hunger, and general "annoyance". Thorndike observed a gradual decrease in responses which led to "annoying" consequences (punishment), and an increase in the responses which led to latch opening (reinforcement). Although Thorndike was later to disavow the importance of annoying stimuli, his work nevertheless anticipated the study of both positive and negative consequences as they affected the activity of experimental subjects.

It is ironic that a psychologist who has most opposed the use of punishment developed the methodology by which the effects of punishment have been discovered. B. F. Skinner (1938) described operant research methods by which the consequences produced by a response altered the likelihood that the response would occur in the future. This methodology has been used extensively during the last 30 to 40 years, and has been the basis for the field of behavior modification.

Skinner conducted relatively little research on punishment, and that which he performed led him to conclude that: "In the long run, punishment, unlike reinforcement, works to the disadvantage of both the punished organism and the punishing agency" (1953, p. 183). Skinner continues "Even under severe and prolonged punishment, the rate of responding will rise when punishment has been discontinued, and although under these

circumstances it is not easy to show that all the responses originally available will eventually appear, it has been found that after a given time the rate of responding is no lower than if no punishment had taken place" (1953, p. 184). Skinner's observations and thinking about punishment led him away from further research on punishment.

A student of Skinner, N. H. Azrin, along with several other researchers, has provided a large portion of the empirical basis for the current understanding of punishment. In a series of studies with laboratory animals these investigators have described several variables which influence the effect of punishing stimuli. Although these studies were conducted with laboratory animals, such as cats, rats, pigeons and monkeys, and although the usual, although not exclusive, punishing consequence was electric shock, subsequent research with humans and consequences other than shock have produced the same general findings. These findings will serve as guidelines for the selection and application of punishing stimuli in the home and school.

Variables Related to Punishment

Introduction

Azrin, Holz, and Hake (1963) describe research which shows that sudden introduction of the punishing stimulus at a high intensity decreases responding more effectively than if stimulus intensity is gradually increased. When the punishing stimulus is only slowly increased, the response may continue, even when the punishing stimulus reaches intense levels. It is as though the subject becomes accustomed to responding in the gradually intensifying situation.

Verbal disapproval, for example, is likely to be less effective when it slowly builds in intensity: "Do you have to do that?....I wish you wouldn't do that.....Please stop doing that.....No stop doing that!.....I'm very angry!!" A more effective procedure would be to introduce a salient stimulus suddenly: "Stop that teasing now! You may not take your sister's toys!"

Intensity

The degree of severity of a stimulus plays a key role in its punishing capacity. Azrin (1960) and Appel and Peterson (1965) showed that mild shock decreased responding less well than moderate shock, which was less effective than severe shock. Furthermore, as time passed, the less severe the punishment, the more the response "recovered". Again, the subjects appeared to accommodate to relatively moderate punishment intensities.

Even if the punisher is introduced suddenly, if it is not of a reasonable magnitude, it may prove ineffective. A pat on the bottom for playing with sharp scissors may be indistinguishable from a pat for saying the ABC's correctly. If punishment is intended, the stroke to the bottom must be sufficiently intense so as to eliminate the confusion between loving approval and loving disapproval.

Immediacy

Similar to reinforcement, as the delay between response and delivery of the punishment increases, the effect of the punisher decreases. Azrin (1956) showed that when delivery of the punisher was delayed, responding initially decreased, but then recovered. When punishment followed the response immediately, however, responding was decreased indefinitely.

There are at least two issues here. As the delay between the response and punishment increases, the opportunity for the response to be reinforced increases. Brief tardiness to school, unpunished, may initially afford the truant only the minimal reinforcement of some "freedom" from a class. Subsequent truancies, however, may involve peer approval and a variety of experiences which effectively compete with the consequences for not going to school. Another problem with delaying punishment is that a desirable response may occur in the interim, and the behavior manager is forced either to deliver the punisher closest in time to a desired response on which it will have its largest impact or to omit the punisher completely. Neither option is very satisfying.

Schedule

A factor which appears to influence the punishing effect of a stimulus is the relation between the occurrence of the response and the occurrence of the punishing stimulus. This relation describes when the punisher is "scheduled" to occur. Research (Azrin et al., 1963; Zimmerman and Ferster, 1963) has shown that the more often a response is punished, the less the probability of the response recurring.

Although there has been some research with intermittent schedules of punishment, it is likely that the receipt of reinforcers for unpunished responses override the efforts that the occasional punishment for those responses might have. If Johnny loses some "free time" only occasionally for his class disruptions, the consequences of peer laughter and approval for unpunished disruptions may easily maintain his unruly behavior.

Escape

An important, although not surprising, effect of punishment was described by Azrin, Hake, and Hutchinson (1965). They showed

that when a subject was permitted to escape from the punishing stimulus, it did so very effectively. Azrin and Holz (1966) suggest that: "...it seems clear that the tendency to escape from a severely punishing situation was sufficiently great to maintain substantial levels of escape responding. These results show that a major effect of punishing a response is to generate a strong tendency on the part of the subject to escape from the punishing situation entirely" (p. 408).

The negative implication of these research findings will be discussed later. It is not difficult to discern, however, that escaping or avoiding punishment which is due creates an intermittent schedule with the same effects on behavior as described above.

Applications of Punishment

A summary of the literature discussed so far suggests the following guidelines for effective use of punishment:

1. Introduce the punisher suddenly, not gradually.

2. Introduce the punisher at a relatively high intensity.

3. Introduce the punisher immediately after the response.

4. Introduce the punisher after each response to be punished.

5. Prevent unauthorized escape from the punisher.

Punishment is a powerful procedure which can offer benefits as well as difficulties. The discussion below will elaborate on the positive and negative aspects of punishment.

Benefits

Rapid. One clear benefit of pnishment is that it can act to rapidly stop well-established response patterns. Lovaas and Simmons (1969) describe the profound decrease in severely self-destructive behavior of autistic children following only six deliveries of response-contingent shock to the arm. Similarly, Risley (1968) described the decrease in dangerous climbing by an autistic child after climbing responses produced a brief shock to the arm or leg. In each case, long-standing, debilitating behaviors were rapidly eliminated, allowing for the acquisition of more appropriate social and academic behaviors.

Informative. Sulzer-Azaroff and Mayer (1977) suggest that: "When punishment is paired with discriminative stimuli, like instructions and gesture, it assists youngsters to discriminate

acceptable from unacceptable behaviors more rapidly" (p. 310). Thus, providing verbal and gestural cues: "No! We don't run near the pool; we walk, like this..." not only decreases the undesired response, but aids in teaching the appropriate response.

Imitation. Extensive work by Bandura (1969) as well as many others suggests that when one individual in a group is punished for a particular response, others in the group also decrease their emission of that response. The teacher may be able, therefore, to reduce disruptive shouting by the reading group members by punishing the initial shouts which occur.

Limitations

Despite the obvious effectiveness of punishment in reducing behavior, there are several factors which may limit its usefulness. These factors do not render punishment useless, but rather qualify its utility and/or the situations in which it might be used.

Escape/Avoidance. As noted earlier, one effect of punishment is to generate responses which allow for escape from the punishing situation. In a classroom, for example, it may be only too easy for a student to leave if she/he is being punished. This escape both renders the punishment ineffective and provides a poor model for the remainder of the class.

Similar to escape is the avoidance of a punishing situation. In this case, unlike that of escape, the child no longer enters the situation where punishment may occur. The "cutting" of class may effectively avoid punitive procedures, and the ignoring of homework may avoid chastisement for poor performance. Perhaps the ultimate avoidance response may be "skipping" school entirely. The great difficulty raised by escape and avoidance behavior is that the child is effectively removed from the opportunity to acquire the skills which are being taught.

"Emotional" behavior. One effect of punishment is that it may produce crying, fearfulness, and other forms of learned or unlearned "emotional" responses. These responses may then compete with responses which are to be learned. Strong punishment -- "No! Peter, that is not correct!" --may leave Peter whimpering in fear, unwilling to volunteer an idea again for days to come. In addition, some punishing stimuli may actually elicit the response which they are intended to eliminate. A spanking for crying or social withdrawal may simply produce louder and longer crying, and more profound withdrawal.

Modeling. Whereas punishment may teach children to imitate the desirable behavior of the punished individual, it may also teach the children to imitate the behavior of the person delivering the punishment. This becomes particularly troublesome when physical punishment, such as spanking, is used, since the teacher or parent inevitably demonstrates how to hit.

Peer reaction. Sulzer-Azaroff and Mayer (1977) point out that another limitation of punishment involves identifying the punished individual as undesirable. "When individuals are continually singled out for punishment, they may themselves become stimuli to be avoided or ridiculed" (p. 319).

Correct response not taught. Regardless of the facility with which a punisher suppresses responses, punishment does not teach the appropriate response for a particular situation. Knowing what not to do does not at all teach what to do. Punishing little Sally's disruptive classroom behavior may quiet her, but she may still remain ignorant about what she is to do with the book and paper in front of her. The implication here is that punishment should not be used as an exclusive behavior change procedure. More will be said about this later.

Stimulus control. One effect of punishment (or reinforcement, for that matter) is that the stimuli associated with the punishing situation can come to control the response. Exposure to punishing consequences teaches the individual that "in this situation, for this response, a punisher occurs." These situational factors, including the parent or teacher who delivers the punisher, can become so much associated with punishment that: 1) they are avoided, as described above, or 2) they are the exclusive suppressers of the undesired response. In the latter case, the response may not occur at home (Mom delivers the punisher) but it occurs often at school (Teacher does nothing); or the response may not occur when Mr. Jones teaches (he punishes the response) but occurs often when Mr. Brown takes over (he ignores the behavior).

Too effective. Martin and Pear (1978) discuss a final limitation which, ironically, occurs because punishment is so effective. The effective use of punishment is extremely reinforcing for the behavior of the user. Acquiring control of a disruptive response by punishment is a very powerful consequence for a parent or teacher. The inclination, then, is to continue to use "what works", and the role of punishment delivery may increase and spread to other responses, to the exclusion of other, more positive forms of behavior control.

When to Use Punishment

Given the power of punishment, and the several pitfalls which await the user of punishment, consideration must be given to when punishment should be employed. The following discussion will suggest some constraints regarding when and how punishment should be used.

That the frequency of a response must be decreased is <u>not</u> necessarily an indication that punishment must be used. In fact,

certain legal decisions (Lake vs. Cameron) suggest that punishment should be used only when less "restrictive" forms of behavior control have been found ineffective. Several of these less restrictive procedures, already discussed, include DRL and DRO schedules and extinction.

When these various reinforcement procedures have not been able to establish responses which compete with the undesired response, punishment may be indicated. In addition to the forms of punishment discussed in this chapter, both timeout and overcorrection are forms of punishment which may be considered. The degree of restrictiveness between different forms of timeout, overcorrection, physical punishment, verbal punishment and so forth will help determine precisely which form of punishment should be used. Becker (1971) suggests three situations which can indicate the need for punishment:

1. When a problem behavior occurs so often there is no good behavior to reinforce.

2. When the nature or intensity of the problem behavior leads to serious questions of safety for the child or others.

3. When the use of reinforcement is not effective because other more powerful reinforcers are causing the problem behavior (p. 127).

Regarding the first situation, it may be that punishment must be used to stop an inappropriate response so that the occasion for a non-punished response may occur. If Johnny never makes appropriate comments in reading group, but continually interrupts with off-topic comments, punishment of the comments may afford the teacher a chance to prompt an appropriate response, and then to reinforce it.

A common illustration of the second case involves a small child running into the street. This clearly dangerous behavior must be punished rapidly in order for the child to survive. Research with autistic children (Lovaas and Simmons, 1969) shows that elimination of self-destructive responses--head hanging, self-mutilation, etc., is prerequisite to the preservation of the child's life, the freeing of the child from physical restraints, and for giving the child the opportunity to learn adaptive behaviors.

When reinforcers for inappropriate behavior are more powerful than currently-available reinforcers for alternative appropriate behavior, punishment may be used to override the reinforcement. The reinforcement of peer approval, for example, may exert more influence on disruptive behavior than a teacher's approval for appropriate behavior. Having exhausted available forms of positive control, the teacher may elect to punish disruptions.

Combinations of procedures

Since the presumed goal of punishment is not only to decrease or eliminate inappropriate behavior, but also to provide the occasion for teaching appropriate behavior, procedures used in combination with punishment are often helpful. Some of these procedures are discussed below.

Avoiding punishment. Paradoxically, one of the best ways to use punishment is to minimize the opportunity for the punished response, or conversely, to maximize the opportunity for appropriate responses. While being prepared to punish, one need not encourage the punished response. Rather, by eliminating the opportunity for the response to occur, punishment is rendered unnecessary, and reinforcement for appropriate behavior is possible. If many class disruptions occur because of the physical arrangement of the class--student desks not in clear view of the teacher—rowdy friends in adjacent seats--classroom procedures which require excessive movement or talking--these disruptions may be lessened by re-arranging the seats, or re-designing classroom procedures and movement patterns. An ounce of prevention...

Such a plan would bring appropriate work responses under the control of positive consequences. Otherwise, the effect of punishment would include a reduction in the amount of reinforcement obtained, and an unpredictable future with respect to what behaviors would replace the punished response.

Stimulus control. In the same fashion that an individual such as a parent or teacher may become associated with the delivery of punishment, so may the occasion for the punished response become a stimulus for <u>not</u> engaging in that response. Andrew, a kindergartner, fails to resist hitting when his little friend teases him, or postures as a "boxer man", despite the teacher's efforts to reinforce alternative behavior or to prevent the teasing and fight posturing of the friend. The teacher decides to teach Andrew that whenever his friend teases or "postures" so much that Andrew wants to hit, <u>then</u> Andrew should say "I don't want to hit," and then seek out the teacher. Over time the occasion for Andrew's hitting becomes an occasion for Andrew to attempt a cooperative response and, that failing, an avoidance response to the friend.

Legal and ethical issues

Finally, if positive approaches have failed to correct the situation, punishment may be indicated. There may be legal or ethical considerations, however, which determine how or what punishment may be applied.

Legal. Martin (1975) points out that there may be considerable limitations on the use of punishing procedures, and that courts have held that <u>any</u> procedure (especially punishment)

used to affect behavior must be the least coercive or restrictive possible which is still effective. Institutional review boards are established to oversee behavior change programs, one function of which is to determine the restrictiveness of particular procedures.

Ethical. Issues here generally have to do with the betterment of the culture by virtue of the use of punishment. That is, is society somehow better because, by permitting punishment by parents and teachers, more of its citizens are able to lead more productive lives than would have been the case without punishment? The issue is, perhaps, drawn most graphically in the case of the severely self-mutilatory behavior of psychotic or retarded children. With no treatment, these children are nearly doomed to an existence defined by the limitations of physical restraints and the willingness of caretakers to provide the basic requirements of life, such as food, toileting, and so forth. It is possible to use a few brief electric shocks (not to be confused with medically prescribed electric-convulsive therapy, ECT) to punish such self-stimulatory behavior. Lovaas and Simmons (1969) have pointed out, however, that extinction may also lead to the elimination of these responses, but only after thousands of responses have occurred. Recent practices have moved away from the use of electric shock, however, and whereas it may still be legal, the bureaucracy of committees and review boards which must approve shock is so complex that the procedure is seldom used. The ethical question here, and in other situations where punishment is indicated is whether society is benefited by having individuals incapacitated in restraints, by having these individuals enter a long, possibly dangerous extinction program, or by having the individuals enter a relatively short but powerful program to eliminate the problem response. There are no clear answers to how these ethical questions should be resolved. Perhaps a guideline would be to consider the consequences of not using a punishment procedure as well as the consequences of employing a punishment procedure.

Forms of punishment

Having determined that punishment is in order, the behavior change agent will choose between two types of punishment, and then among a wide variety of forms within these types.

Positive punishment. Positive punishment involves the presentation of some event contingent upon the punished response. Physical stimulation, such as spanking, electric shock, or squirts of lemon juice in the mouth, are examples of positive punishment. Also, commands, such as "No! Don't touch that!" and "Stop!" are examples of positive punishment. Overcorrection, discussed in chapter 6, is a complex form of positive punishment.

Negative punishment. The withdrawal of stimuli contingent on a response defines the use of negative punishment. Removal of toys, privileges, points, and so forth, contingent on a response, are examples of negative punishment. Timeout procedures, discussed in chapter 4, are examples of negative punishment, since the behaving individual and available reinforcers are removed from each other's company.

The discussion thus far has provided a reasonable background for many research and practical issues regarding punishment. Some examples of punishment follow, but the behavior change agent should be aware that the effective use of punishment will demand as much creativity in identifying specific punishing stimuli as it will demand technical knowledge about the punishment process.

Illustrations of Punishment

Case 1. Five-year-old Jeffrey pays little attention to the instructions of mother at home or teacher in Kindergarten. He persists in reaching onto counters or desks for things, often risking being burned or cut by objects which he cannot see. The parents and teacher agree that when Jeffrey reaches either at home or in school, the reaction of the caregiver should be: "No reaching, Jeffrey! That's dangerous!" followed by a quick spank on the bottom. Jeffrey should be taught to ask for help and should receive praise and physical contact (pats, hugs) for asking for help or for not reaching for determined periods of time.

Note that this situation assumes a clear risk to the child. Note also that there has been a prior agreement between parent and teacher for a consistent procedure, including physical punishment. Finally, note the inclusion of a reinforcement plan for other responses which compete with reaching.

Case 2. Marcia is a 10-year-old child who suffers from some fine motor difficulty and "mental retardation" due to cerebral palsy. She is in a program to teach self-feeding skills at school and at home, but she is a "fussy" eater, wanting only her favorite foods -- desserts. She earns a piece of dessert for every bite of "good" food she eats; but she often throws the good food on the floor and screams for the dessert, which the caregiver provides. The program here calls for the teacher and parent to heavily praise Marcia for proper eating, and to remove one piece of dessert each time Marcia throws good food on the floor.

Note that in this situation current reinforcement for proper eating may not be competitive with occasional bits of dessert which Marcia obtains through tantrums. The behavior change program relies heavily on social and food (dessert) reinforcement, and includes a negative punishment component in the form of a response cost -- the loss of a potential reinforcer contingent upon the emission of the undesired response.

Case 3. Gene is a normal, healthy 13 year-old. He has begun to "hang out" with friends before and after school, however, making him late for classes, and late getting home to finish his chores. His school performance has begun to suffer. Parents and school counselors have encouraged Gene to do better, but no change has occurred. A plan is devised, in collaboration with Gene, the parents, and teachers of the classes to which Gene usually is late. This plan calls for Gene to receive one extra homework problem for every minute late to class and returning home. Gene must finish the homework before going out with "the guys" in the evening. Heavy praise from parents and teacher is scheduled for Gene's punctuality and improvement in class.

This is an example of positive punishment (extra work) as well as negative punishment (response cost -- lost of time with "the guys") for tardiness. The reinforcement obtained through social contacts clearly overrides the current reinforcement for punctuality, so additional reinforcement (praise) and the punishment contingency are introduced.

Case 4. Martin and Pear (1978) report the case of Ricky, a retarded boy who severely bit and scratched other children. Routinely Ricky was required to wear a face mask (like a catcher's mask) to prevent bting. Rather than require Ricky to wear the mask continuously, however, the staff began a program in which Ricky was required to wear the mask for ten minutes contingent on a biting response. Ricky was also heavily praised for "not biting" (a DRO). Biting quickly ceased. Ricky then was required to wear the mask for scratching as well, with the added contingency of brief shock for scratching <u>while the mask was on</u>. Scratching was quickly eliminated.

This case illustrates two positive punishment procedures which were necessary to prevent injury to other children. The face mask was tied on to Ricky, preventing escape, and it served as a signal for Ricky that if he scratched while wearing it, shock would result.

Case 5. Tanner and Zeiler (1975) described the punishment of self-injurious behavior using aromatic ammonia capsules. Each time the autistic subject slapped herself, a capsule was held near her nose; slapping rapidly decreased. With the elimination of slapping, the subject could be freed from restraints and introduced to more positive forms of teaching.

Martin and Pear (1978) nicely summarize a variety of considerations in the use of punishment:

1. **Selecting a response.** Punishment is most effective with a specific behavior (such as jumping on the arm of the chair) rather than a general catcgory of behavior (such as wrecking furniture).

2. **Maximize the conditions for a desirable (nonpunished) alternative response.**
   a) Select a desirable alternative behavior that competes with the behavior to be punished such that the alternative behavior can be reinforced. If possible, select a behavior that will be maintained by the natural environment after the termination of your reinforcement program.

   b) Provide strong prompts in order to increase the likelihood that the desirable alternative behavior will occur.

   c) Reinforce the desirable behavior with a powerful reinforcer on an appropriate schedule.

3. **Minimize the causes of the response to be punished.**
   a) Try to identify and eliminate many or all of the stimuli controlling the undesirable behavior, at least early in the training program.

   b) Try to eliminate any possible reinforcement for the undesirable behavior.

4. **Select an effective punisher.**
   a) Choose an effective punisher that can be presented immediately following the undesirable behavior.

   b) The punisher should be one that will in no way be paired with positive reinforcement following the undesirable behavior.

   c) Select a punisher that can be presented following every instance of the undesirable behavior.

5. **Delivering the punisher.**
   a) The punisher should be presented <u>immediately</u> following <u>every</u> instance of the response to be decreased.

   b) The individual administering the punisher should do so in a calm and matter-of-fact manner.

   c) The person doing the punishing should also be associated with a lot of positive reinforcement for alternative behaviors, so that the person does not become a conditioned punisher.

   d) Take care not to pair punishment with reinforcement.

6. In all programs involving punishment, careful data should be taken on the effects of the program. The conditions under which the program should be applied must be clearly stated, written down, and adhered to.

Summary and Conclusions

This chapter has attempted to illustrate that there are stimuli which by occurring contingent on a response will suppress that response in the future. These stimuli, called punishers, are affected by a variety of parameters, including the nature of the stimuli, the timing of its delivery, the nature of the response to be punished, the stimulus situation in which the punished response occurs, and the existence of concurrent reinforcement contingencies.

That punishers can be used effectively to modify behavior in homes and schools is not at issue. Nature provides her own demonstrations of punishment, and a number of more controlled if not more elegant research results have been suggested.

In the final analysis, the determination about the use of punishment may turn on the ethical issue of how the greatest good is served -- by doggedly pursuing somewhat slower-acting, but positive, approaches, or by implementing rapidly-acting but more drastic approaches. Beer (1970) summarizes the dilemma well:

> Am I arguing that a better life is an end which justifies a means to that end even as immoral as punishment? Clinical practice is too complicated, I believe, to allow even that simple formula to apply. Not to rescue a person from an unhappy organization of his behavior is to punish him, in that it leaves him in a state of recurrent punishment. The punishment may not be faradic (electric shock) but apparently it hurts nonetheless. When the seventy-seventh girl that you have met starts edging away, staring strangely as you blink furiously on to new achievements in rate, then I think that in your misery you may ask your therapist some pressing questions. Among these should be the following:

1. Why won't you shock those blinks out of me? People hurt me when I blink at them; they do it every day and have done so for years; and either I turn into a hermit or they will keep hurting me the rest of my life.

2. All right, you're going to do it with positive methods instead. How long will it take?

3. All right, you're going after the real dynamics, not just the symptoms. How long will it take?

That question, How long will it take? is the morally critical question, in my opinion. For as time goes by while the therapist tries his hopefully more benevolent or more basic methods, the patient still undergoes punishment while he waits for a good outcome. In effect, the therapist has assigned the patient to a punishment condition from which he might have long since removed him. This robs that therapist of any moral superiority over another therapist who will assign the patient to shock punishment so that he may escape from social punishment. The basic questions would seem to be, which punishment is tougher, and which lasts longer? We have merely a bookkeeping problem here, not a moral one.

References

Appel, J. B. and Peterson, N. J. Punishment: effects of shock intensity on response suppression. Psychological Reports, 1965, 16, 721-730.

Azrin, N. H. Effects of two intermittent schedules of immediate and non-immediate punishment. Journal of Psychology, 1956, 42, 3-21.

Azrin, N. H. Effects of punishment intensity during variable-interval reinforcement. Journal of the Experimental Analysis of Behavior, 1960, 3, 123-142.

Azrin, N. H., Hake, D. F., Holz, W. C., and Hutchinson, R. R. Motivational aspects of escape from punishment. Journal of the Experimental Analysis of Behavior, 1965, 8, 31-44.

Azrin, N. H. and Holz, W. C. Punishment. In W. H. Hoing (Ed.) Operant Behavior: Areas of Research and Application. New York: Appleton-Century-Crofts, 1966.

Azrin, N. H., Holz, W. C., and Hake, D. F. Fixed-ratio punishment. Journal of the Experimental Analysis of Behavior, 1963, 6, 141-148.

Baer, D. M. A case for selective reinforcement of punishment. In C. Neuringer & J. Michael (Eds.), Behavior modification in clinical psychology. New York: Appleton-Century-Crofts, 1970, 246-247.

Bandura, A. Principles of behavior modification. New York: Holt, Rinehart and Winston, 1969.

Becker, W. C. Parents are teachers. Champaign: Research Press, 1971.

Catania, A. C. Learning. Englewood Cliffs: Prentice-Hall, 1968.

Lake v. Cameron, 364 F. 2d. 657 (D.C. 1966).

Lovaas, O. I. and Simmons, J. Q. Jr. Manipulation of self-destruction in three retarded children. Journal of Applied Behavior Analysis, 1969, 2, 143-157.

Martin, G. L. and Pear, J. J. Behavior Modification. Englewood Cliffs: Prentice Hall, Inc., 1978.

Martin, R. Legal Challenges to Behavior Modification. Champaign: Research Press, 1975.

Risley, T. R. The effects and side effects of punishing the autistic behaviors of a deviant child. Journal of Applied Behavior Analysis, 1968, 1, 21-34.

Skinner, B. F. The Behavior of Organisms. New York: Appleton-Century-Crofts, 1938.

Skinner, B. F. Science and Human Behavior. New York: MacMillan, 1953.

Sulzer-Azaroff, B. and Mayer, G. R. Applying behavior-analysis procedures with children and youth. New York: Holt, Rinehart and Winston, 1977.

Tanner, B. A. and Zeiter, M. Punishment of self-injurious behavior using aromatic ammonia as the aversive stimulus. Journal of Applied Behavior Analysis, 1975, 8, 53-57.

Thorndike, E. L. Animal intelligence: an experimental study of the associative processes in animals. Psychological Review Monograph Supplements, 2 (No. 4), 1898.

Webster's New World Dictionary, College Edition. New York: World Publishing Company, 1964.

Zimmerman, J. and Ferster, C. B. Intermittent punishment of S responding in matching-to-sample. Journal of the Experimental Analysis of Behavior, 1633, 6, 349-356.

Extinction

The Ends and Means of Ignoring

by

Rebecca Barloon-Noble
Santa Barbara, California

Introduction

extinction (ext)
operant extinction: (1) as operation: the withholding of a reinforcement previously contingent upon a response. (2) as process: the resulting decrease in probability or rate.
respondent extinction: (1) as operation: the presentation of a conditioned stimulus occurring without the unconditioned or reinforcing stimulus. (2) as process: the resulting reduction in the magnitude or other dimension of the response elicited by the conditioned stimulus.

——Ferster and Skinner, 1957

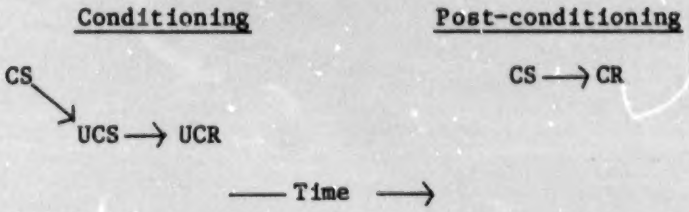
The existence of an operant response, the major component of the human repertoire, is testimony to past or present reinforcing stimuli being presented upon the occurrence of that response. Such a contingency, defined as "the effect of a response on the probability of a stimulus,"[1] may be based on intermittent or continual reinforcement, and constitutes the relationship whereby most behavior is shaped and maintained. It is important to remember that reinforcing properties do not lie in stimuli but in their effect on behavior. There are a number of variations in the form of contingencies; much of this book is dedicated to describing some of those which decrease the probability that a given behavior will occur. Obviously, there also exists a spectrum of contingencies which increase the probability that the behavior of interest will occur, and each of those results in a unique pattern of performance. "The causes of, or controls over, behavior are found in the way that behavior has been related to reinforcement in the past."[2]

One of the many contingencies in which responses and stimuli are associated can be described by the following statement: $p(S^r) = 0$, where p = probability and S^r = reinforcing stimulus. In this case, obviously, reinforcement for a given specific behavior is never forthcoming. It is this special contingency, called extinction, which will be covered by this paper.

It is appropriate to treat extinction in terms of persisting effects of reinforcement rather than as a phenomena separate from the conditioning that produced the behavior. Thus, the decrease in responding during extinction is not a special process requiring a separate treatment; rather, it is part of the process generated by the reinforcement operation. As such, performance during extinction is directly related to the behavior's prior schedule of reinforcement as well as all other factors in the organism's reinforcement history. As in conditioning, there are two major extinction paradigms: operant and respondent. We will treat the latter first.

Respondent Conditioning and Extinction

The respondent conditioning paradigm, is:



where CS is the conditioned stimulus, CR is the conditioned response, UCS is the unconditioned stimulus, and UCR is the unconditioned response. The paradigm defines reliable stimulus-response relationships which are called reflexes. In his classic example, Pavlov exploited the reflex of salivation at the sight of food (UCR) by presenting a metronome (CS) just prior to presenting the food (UCS). Eventually the metronome came to elicit salivation on its own (CR), representing the classical (respondent) paradigm. In respondent extinction, the conditioned stimulus (the metronome in our example) is presented repeatedly without being followed by the unconditioned stimulus (food). Over the course of several trials, the CS no longer elicits the CR; it has lost its association with the UCS.

As a physiologist, Pavlov resorted to internal constructs and neurological phenomena to explain both conditioning and extinction. He, like Thorndike, assumed that extinction occurred due to an accumulation of inhibitory effects which overcame the effects of conditioning. "It is clear that the more vigorous a conditioned reflex, or in other words the greater the intensity of the excitatory process, the more intense must be the inhibitory process in order to overcome it, and therefore the greater the number of unreinforced repetitions necessary to bring about

complete extinction. Again, it was seen that a repetition of the non-reinforced conditioned stimulus was necessary to produce a sufficient summation of the inhibitory after-effect for complete experimental extinction, and it is reasonable to suppose that the shorter the intervals between successive repetitions of the stimulus the more quickly will the required intensity of the inhibitory process be obtained."[3] Numerous other such explanations have more recently been invoked; the problem in all such hypotheses is their inability to submit themselves to visible, reliable, data-based scrutiny (Catania, 1979).

Essentially, respondent extinction is the decrease in strength of the conditioned response due to termination of the pairing with the unconditioned response, or nonreinforcement of the CR. It follows a gradual course of response decrement over time: the specific course that extinction takes is dependent upon a number of variables such as strength of unconditioned and conditioned response, rapidity of extinction trials, and number of prior extinctions of the reflex. Extinction, as a process, generalizes; the extinction of one CR will result in partial extinction of other CRs and the degree of generalization depends upon the degree of similarity between the responses. Furthermore, only occasional pairings of the UCS with the CS are sufficient to maintain responding.

When a conditioned response has been experimentally extinguished, i.e., it has not been elicited by the conditioned stimulus for some time, it will recover some of its strength without additional training. It has "spontaneously recovered." In successive experimental sessions, the percentage of trials in which this occurs is larger in the beginning of the session than in the end of the prior session, and gradually decreases within each session. Pavlov also employed his theory of inhibition as an explanatory mechanism for spontaneous recovery: the inhibitory effects of extinction, he hypothesized, dissipate over the course of time and allow the response to visibly occur. Regardless of the explanatory mechanism, the observable behavior remains the same.

Obviously, the fact that a previously neutral event can come to elicit a response in an organism must have some evolutionary survival value in order to be maintained as a process in the repertoire of organisms. Concomitantly, extinction can be understood in terms of adaptivity; if the UCS repeatedly failed to follow the CS, it would be of little value for the organism to continue to respond. However, too rapid or complete an extinction of a previously acquired association may be premature or maladaptive. Many forms of psychosis or neurosis are attributable to the nonadaptivity of a conditioned response pattern. Behavior that at one time was functional is no longer so, but continues to be performed. Wolpe has developed a technique called reciprocal inhibition for eliminating such maladaptive responses. According to him, many pathological behaviors are actually avoidance

responses to a stimulus which irrationally elicits fear or anxiety. If the response to the conditioned stimulus is replaced by a more functional response, then the pathology no longer exists; the behavior has been inhibited by a reciprocal response which is antagonistic to the fear response. Wolpe often employs systematic desensitization as the vehicle for establishing the more functional response, deep muscle relaxation.

Another form of behavior therapy derived from the classical conditioning paradigm is called imposive therapy. This technique intends to elicit the conditioned anxiety response by presenting the conditioned stimulus but then withholds the unconditioned response (the avoiding behavior). The conditioned response, obviously, will eventually extinguish when it is no longer follwed by the UCR. "If a person is repeatedly and extensively exposed to the conditioned anxiety-producing stimulus in situations where anxiety is not reinforced, the response (both the anxiety and anxiety-avoiding behavior) will eventually extinguish."[4] To facilitate the process, Stampfl, its originator, presents many vivid descriptions of the anxiety-producing situation to his client. It is assumed that the extinction will generalize to other settings.

Respondent conditioning and extinction are paradigms which explain a portion of the human repertoire; they are necessarily confined to those behaviors acquired by their association with unconditioned stimuli. If the spectrum of human behavior were necessarily reliant on this form of learning, it would be narrow indeed. To account for most other instances of behavioral acquisition, we must turn to the operant.

Operant Conditioning and Extinction

Extinction in respondent conditioning is not the same as in operant conditioning. In the extinction of respondent behavior, the CS must be presented a number of times without the UCS. In the extinction of operant behavior, the response must occur and not be reinforced. The conditioning of operant behavior takes many forms, and we will explore these prior to an examination of the extinction curves associated with each.

An operant is a behavior or response which has a functional relationship with a consequence that follows it such that the latter affects its rate of occurrence (number of responses in terms of time); operant conditioning describes the process of assigning consequences in order to alter the probability that the operant will occur. Operant rate can be affected by either

reinforcing or punishing consequences, and, in fact, reinforcers and punishers are defined not by social values but by the effect that they have on the probability that an operant will occur in the future.

We term an event reinforcing when its functional relationship with a behavior increases the rate of that behavior; there are both positive and negative reinforcement paradigms. In positive reinforcement, the presentation of a stimulus contingent on a given specified response increases the probability that that response will occur in the future. In negative reinforcement, the withdrawal of an ongoing aversive stimulus contingent on a given specific response increases the rate of that response. Two forms of negative reinforcement are avoidance and escape. Note that in all reinforcement paradigms, the rate of the response increases; reinforcement of any kind, by definition, increases the probability that that response will occur in the future. It is important to remember this to maintain a clear differentiation between negative reinforcement and punishment.

Behavior can be reinforced in many ways: after every occurrence (continuous reinforcement or CRF), after every x^{th} response (fixed ratio or FR-x), on a variable pattern that surrounds some average number of responses (variable ratio or VR), for the first response after a specific amount of time (t) has elapsed since the last reinforcement (fixed interval or FI-t), or for the first response after a variable amount of time which averages a given length (variable interval or VI). The schedule of reinforcement determines the pattern and rate of responding that an organism exhibits during both conditioning and extinction. This is as true of students in the classroom as it is rats in the laboratory.

In negative reinforcement, a response that terminates an ongoing aversive stimulus becomes more likely to occur given similar future conditions. In avoidance, the performance of a given behavior will prevent the onset of the aversive stimulus; the organism is therefore rewarded for behaving. In escape, a given behavior will in some way curtail the presentation of an ongoing aversive stimulus. In the former case, it is possible (but not probable) that the organism never come in contact with the aversive event after training. In escape, however, contact with the aversive event is always made but can be quickly terminated by responding.

Operant extinction is defined as the resulting decrease in strength of a conditioned response when it is no longer positively or negatively reinforced. "The operation of discontinuing reinforcement is called extinction, and when responding decreases

to its earlier level as a result of this operation the response is said to be extinguished."[5] We again note that the effects of reinforcement are temporary and see extinction not as a separate process but one entirely generated by the reinforcement operation.

Extinction must be clearly differentiated from forgetting. Forgetting is the loss of the effects of conditioning merely due to the passage of time; the response does not occur in that interval. In extinction, however, the response occurs and is simply not reinforced in the circumstances in which it has previously been conditioned. Whenever environments radically change following response acquisition, forgetting is not so great. The amount of interference from intervening responses is greatly related to the similarity of those responses with the response to be remembered; the mere passage of time has surprisingly little effect. Skinner (1950) trained pigeons to peck and then removed them from the stimulus situation for four years. When replaced in that environment, the pigeon immediately resumed responding as if no time had intervened. In view of these facts, most theories of memory explain retroactive inhibition, forgetting due to intervening learning, in terms of extinction (or unlearning) and relearning of competing responses. For example, if an individual moves from one verbal community to another (changing languages), his initial verbal behavior may undergo extinction because there is no one who can reinforce the behavior and because he has learned the competing response of a new language (Skinner, 1957).

When a reinforcing consequence is withheld, the course of the ensuing extinction is dependent upon six variables: 1) the prior schedule of reinforcement, 2) the magnitude of the reinforcer, 3) the number of reinforcements prior to extinction, 4) the number of previous extinctions experienced by the organism, 5) magnitude of motivation (level of deprivation), and 6) the effortfulness of the response. In general, a shorter history of reinforcement and high effort necessary in making the response bring quicker extinction. A high motivation group may yield nearly double the number of responses in extinction yet the same relative curve as other extinction groups. In some respects, extinction is the measure of operant strength, and "resistance to extinction" is often used as a dependent variable. This resistance can be evaluated in terms of rate of responding, time up to the point where a low rate criterion is met, total number of responses made before the level returns to baseline rate, or designation of an overall slope.

Of all the six variables, reinforcement schedule is by far the most important in determining the course of extinction. In general, when relevant parameters are held constant, ratio schedules produce a large number of resposes but interval schedules require the longest time for extinction. Fixed ratio responding during extinction is marked by abrupt pauses followed by the high rate of responding that prevailed during reinforcement, so that the curve is almost in squares. Usually

there are no intermediate rates. Extinction occurs because, as overall rate of responding approaches zero, the pauses become longer and the periods of responding shorter. However, when responding occurs, it does so at its former high rate. Most of the responding occurs very early in extinction.

Extinction following variable ratio reinforcement also shows a high sustained rate of responding interspersed with abrupt periods of nonresponding. "The lack of intermediate rates of responding during extinction after ratio schedules is additional evidence for the tightly chained character of the responding in the ratio."[6] Such long pauses in ratio responding are often referred to as "straining the ratio," i.e., the ratio of responses to reinforcement is made too high too quickly.

Extinction following reinforcement on a fixed interval schedule of reinforcement is characterized by a scallop pattern: accelerated periods of responding followed by abrupt pauses which become longer as the overall rate of responding approaches zero. Performance following a variable interval schedule, however, is characterized by a steadily decreasing rate without abrupt pauses.

Behavior maintained on any of these intermittent schedules of reinforcement is more resistent to extinction than behavior maintained by continuous reinforcement. "Partial reinforcement on some schedule is more like extinction than is constant reinforcement and, hence, harder to tell from extinction. To the extent that the conditions of reinforcement resemble the conditions of extinction, there will be more responses during extinction."[7] Extinction of a continuously reinforced response can occur following the occurence of only one nonreinforced response, which has led workers to suggest a discrimination hypothesis to explain the process of extinction: not being reinforced acts as a signal that further reinforcement is not forthcoming, so the organism stops responding. Animals can eventually acquire such a fine discrimination that as soon as one response goes unreinforced, it stops responding (Whaley and Malott, 1971). Furthermore, when cues are provided that signal extinction, the process is accelerated; consequently, extinction is faster for the fixed than for the variable schedules. In the former, disruption of the pattern of regular reinforcements serves as a signal for extinction; in the variable schedules, no such pattern is there to be disrupted (Rachlin, 1970).

Occasionally, the frequency of operant performance may temporarily increase before beginning to decline at the onset of extinction. "Such cases point to the importance of using the term extinction precisely, as the withholding of reinforcement, rather than a description of a change in behavior, or the effect of withholding reinforcements."[8]

Once the extinction procedure begins, rate and frequency changes in the behavior are not the only differences seen. It is not uncommon for the organism to begin to exhibit emotional or aggressive responses, and, in fact, the opportunity to aggress can become a reinforcer under these conditions. Such evidence suggests that extinction, or lack of reinforcement, is aversive for the organism; as such, it is emplicit that other reinforcing contingencies be maintained while extinguishing the operant. Not only are there side effects to the procedure, but the response being extinguished typically changes in structure and topography. It may be more forcefully executed or performed in a varied manner. Breakdown of the sequential structure of the behavior itself and with other behaviors in a chain occurs. Selective extinction of the parts of a chain up to the point of the "fracture" is seen.

Once a response has been extinguished to some criterion level of performance, it will reoccur after time. This unsolicited emergence of the operant is called spontaneous recovery, as in classical conditioning, and appears as if the organism is checking to see whether the contingency may again be in effect. Extinction of a spontaneously recovered response is rapid and does not mean that extinction has been forgotten, for successive extinction shows the results of earlier ones.

To exemplify all of the aforementioned experimental conclusions, let us take the instance of a mother whose child interrupts her conversation 50 times a day. Sometimes she answers him immediately; other times she pretends she doesn't hear him, or tries to ignore him but then decides that he'll go away quicker if she answers. In doing this, she has put him on an intermittent variable schedule of reinforcement which will be more resistant to extinction. One day she decides she's had enough; consultation with the school psychologist results in the recommendation to consistently withhold reinforcement (attention). On the first day of the program, not only is he interrupting her more often, but he does it louder, grabs her to get her attention, and, later in the day, starts hitting her. Do we assume that extinction "doesn't work?" No. If Mother was able to analyze the contingency prior to "ignoring," she would have been prepared for all these occurrences as temporary by-products of the procedure, which she should continue to implement. What often happens, however, is that a more intense form of the behavior (in our example, yelling to interrupt) is reinforced by attention; when this happens, the operant of "interrupting loudly" has been differentially reinforced on an intermittent schedule and hence is more likely to occur in the future. We have covered extinction of positively reinforced responses; now let us turn to negative reinforcement.

In avoidance, if an aversive stimulus is never presented, avoidance responding will eventually extinguish for lack of reinforcement. It will also extinguish if the aversive stimulus occurs regardless of whether or not the avoiding response is made.

In the former instance, avoidance behavior is extremely resistant to extinction. Avoidance responding that is successful prevents contact with the aversive stimulus, hence the organism may be unable to discriminate periods of extinction from periods of successful avoidance. Slow, inefficient extinction of avoidance is seen by some behavioral therapists as a major parameter in much adult human neurotic behavior.

If the aversive stimulus is reintroduced, the prior avoidance behavior will increase in rate, even if it is no longer successful. In other words, the introduction of unavoidable noncontingent aversive stimuli will strengthen a response that was previously but is no longer successful in avoiding it, thus prolonging extinction. Thus it is important to distinguish between terminating contingencies between responses and aversive stimuli and terminating aversive stimuli. The rate of extinction following negative reinforcement depends on the rate at which aversive stimuli occur both before and after the onset of extinction (Catania, 1979). Extinction of escape is reliant on the form of the paradigm; if the aversive stimulus is presented but the response not reinforced by its termination, the process is slow and erratic. If the aversive stimulus is no longer presented, some responses do occur due to the presence of other stimuli associated with the aversive, but extinction is rapid.

A response that occurs under one condition and is reinforced will also occur, to a lesser degree, under conditions of varying levels of similarity to the reinforcement condition. Conversely, the weakening effects of extinction spread to stimulus conditions other than the particular one under which extinction was carried out. The former phenomenon is called stimulus generalization and the latter generalization of extinction; they are inverse procedures. "Thus, a given frequency of responding might prevail under stimuli A, B, and C because of earlier conditioning. If the response now goes unreinforced in the presence of B, the decrease in frequency is maximal in the presence of B, but less in A and C."[9] Organisms are more apt to attend to the properties of stimuli correlated with reinforcement than to those correlated with extinction.

If punishment, the arranging of consequences that reduce the probability of the responses they follow, is presented during extinction, the total number of response elicitations necessary may be somewhat reduced, but the time required for complete extinction is not affected. Although the rate of responding decreases rapidly during punishment plus extinction, an increase follows the termination of punishment during extinction. The result is that the total number of responses during extinction changes very little by the addition of a punishment contingency. Mild punishment doesn't permanently suppress the extinction process; it merely postpones it.

Behavior can be vicariously extinguished in those who watch a model make a nonreinforced (and nonpunished) response. This extension of the extinction paradigm has been employed in eliminating fearful avoidance behavior in children. A model is seen to display progressively stronger and more positive approach behavior to the avoided object without aversive consequences. The more diverse the modeling cues presented, the more enduring the maintenance of the extinguished avoidance responses.

A prevailing idea in all controls over responding "is the notion that certain behavioral effects are conditional upon a certain history of conditioning and extinction....Note that each case may be reduced to a combination of only two ingredients: conditioning and extinction. The variety of behaviors that can be acquired and maintained through their use, and the complexity of the environmental controls over behavior that their correlation with stimuli can induce, testify to their remarkable potency."[10] Shaping is the process of establishing a response that did not formerly exist in the organism's repertoire. It is accomplished by successively reinforcing responses that more closely approximate the desired response and extinguishing responses that do not. In systematic desensitization, the relaxation procedure mentioned on page 5, anxiety responses in the presence of successively more fearful situations are extinguished. Discrimination is achieved by reinforcement of responding in the presence of one stimulus (S^D) and extinction of responding in the presence of another stimulus (S^Δ). Over the course of time, responding in the latter gradually disappears.

Given the experimental data as a basis, we now turn to the more pragmatic ramifications of extinction.

Extinction and Other Decelerative Procedures

The selection of a procedure to eliminate or decrease the rate of a given response is necessarily dependent upon a number of legal, ethical, and methodological considerations of which the question of the right to intervene is but one. Hopefully, the previous sections have delineated the major experimental variables to consider in analyzing contingencies for purposes of extinction. There are other ways of changing behavior; examples are response contingent withdrawal of reinforcement, satiation, stimulus change restraint, increasing the frequency of an incompatible behavior, and punishment. However, "the decision should not automatically be to use one of them in order to avoid the use of punishment.

For example, extinction is not equal to punishment in implementation or effects, and a therapeutic decision must be made on the basis of empirical evidence about the characteristics of the paradigms and the needs of the situation, rather than on philosophical grounds."[11]

The choice of a decelerative procedure, too, is influenced by the legal mandates which have recently been enacted to control their use in public institutions. Since the raison d'etre for differential treatment is re-entering the mainstream, a scheme for motivating a student to perform appropriate behaviors, as well as decelerating the undesirable, is implicit (Martin, 1975). Many unwitting behavior modifiers extinguish appropriate responses; Madsen, Madsen, and Driggs (1971) reported such a case. A child who was taught in individual therapy that hand-raising is appropriate attention-seeking behavior for the classroom was returned to class. On the first day back in class after therapy, he raised his hand for 50-seconds before putting it down after not being recognized. As the teacher continued to not recognize him, he raised his hand for shorter and shorter periods, first 32-seconds, then 23-seconds, then 18, 7, and 1. He then resumed his previous behavior of blurting out loudly when he wanted to be recognized. This behavior received a response from the teacher, an unwitting reinforcement. Positive reinforcement is so rare in some classrooms that an extinction schedule for almost any appropriate behavior could be considered to be in effect.

In general, extinction meets the guidelines as a less restrictive alternative than, say, punishment. However, the time differential in its use must be ethically weighed in terms of the severity of the behavior. Since we see extinction as a large part of the natural contingencies in our environment, we may be hard put to regulate its systematic use. But a little information may be dangerous, and the unsystematic application of a process of behavioral adaptation may cause more harm than good. Certainly it should never be implemented only to document a need for a more restrictive program. "Part of the reason for the widespread use of aversive control is the immediate reinforcement of the behavior of the controller coupled with the delayed occurrence of the unwanted side effects."[12] (See Duncan article on Punishment for description of these latter.)

The essence of the most appropriate, need-based, and least restrictive program can only be determined by careful analysis of the behavioral contingencies; once this is accomplished, a differential intervention strategy can be developed which will maximally meet the demands of the given situation. No cookbook method of psychology will enable anyone to do this effectively.

The Use of Extinction as a Therapeutic Procedure

Although there is no step-by-step procedure for the implementation of extinction as a purposeful behavior change strategy, there are some guidelines which are directly derived from the experimental literature. Prior to designing any intervention strategy, the baseline rate of occurrence of the behavior and its consequences should be determined through objective observation and measurement. This serves three purposes: 1) it gives feedback about whether the behavior actually occurs more often than it should, 2) it provides a forum for determining what is reinforcing the behavior, and 3) it serves as a standard whereby the effectiveness of the extinction strategy can be evaluated (Drabman, Jarvie, and Archbold, 1974).

If a teacher determines the baseline, he/she should also determine what the reinforcing stimulus for the response is. If the stimulus that maintains the inappropriate behavior is teacher attention, then it may be appropriate to extinguish the behavior by withdrawing the attention. "If you remember that, to many children, scolding is more reinforcing than no attention at all, you can see that it is not what is said to the child that is so important. It is when it is said, the contingency of the interaction with the child. If your attention is contingent upon (i.e., follows) misbehavior, then it pays off misbehavior. If you remove the payoff, the behavior should gradually grow weaker."[13] A study by Madsen, Becker, Thomas, Koser, and Plager noted that the phrase "Sit down" reinforced standing even in classroms which were described as "good."

If it is determined that the reinforcing stimulus is peer attention, then extinction is not appropriate as a control technique. Although the teacher may ignore the misdeed, his/her attention is not the maintaining stimulus. Other strategies may be employed to eliminate peer attention to the behavior, and thus the behavior itself. Obviously, then, it is crucial to correctly analyze the ongoing contingency. If an extinction procedure does not effectively reduce the response it follows given sufficient time, then it is probable that the reinforcer has been misidentified. Similarly, it is impossible to withhold reinforcement from behaviors (for example, masturbation) that are self-reinforcing. If this is the case, then they cannot be extinguished. Finally, for behaviors that are highly likely to be imitated by those who observe them, it is not appropriate to use extinction. The flow chart (Appendix I) will aid in determining the utility of the extinction procedure for a specified classroom behavior problem.

When an extinction procedure is implemented, the teacher must be cognizant of and prepared for the alterations in response rate and topography that will invitable ensue. The burst of responses

in the early stages of extinction should come as no surprise; neither should the increased intensity of response. However, the teacher should know what kinds of responses to expect and how to deal with them (ignore!). She should also know that accidental attention may not only intermittently reinforce the response (making it more resistant to extinction) but may also differentially reinforce a more extreme or intense form of the behavior. One of the cardinal guidelines in extinction is, therefore, to be consistent. If this is not possible, another strategy for decelerating the behavior should be considered (Gilbert, 1975).

It is extremely important for the teacher to reinforce an appropriate desired behavior when extinguishing an undesired behavior. This not only serves to provide a clear discrimination of appropriate performance for the student, but also helps to allay some of the frustration responses seen in extinction. If other inappropriate behaviors occur during extinction, they should be treated as is the initial misdeed and extinguished. Sajwaj, Twardosz, and Burke (1972) suggested that a response class be defined as a group of behaviors that covary directly and/or inversely, even though the environment acts only on one of its members. Such behavioral covariation would be the anticipated result of extinguishing one response of a class and would explain the phenomenon of "symptom substitution."

Reinforcement should not occur immediately upon ceasing to emit the inappropriate response because it is desired that responses inimical to the operant be reinforced, not cessation of the operant, as a response class. Furthermore, reinforcement made available during the extended period of nonoccurrence of the operant in question should not be qualitatively or quantitatively different from the reinforcing stimuli presented shortly after the cessation of the operant. Reinforcing stimuli should be made readily available during the entire period in which the relevant operant is not in evidence in order to strengthen responses incompatible with the occurrence of the operant (Cahoon and Wenrich, 1965). Finally, the teacher should expect that the behavior will spontaneously reoccur after it has been extinguished for some time. He/she must know that maintaining extinction will almost immediately re-eliminate the behavior, but, again, that reinforcement could be disastrous.

Extinction as a therapeutic procedure is the most facile to describe and therefore the most difficult to implement. Due to the proverbial "ignore it and it will go away," many well-meaning strategies have been incorrectly applied or analyzed. It is paramount that the procedure of ignoring be applied with the same degree of caution as other decelerative strategies, for, as can be seen by this paper, the potential for misapplication, and therefoe, misuse, is great.

Illustrations of Extinction as a Therapeutic Procedure

Since extinction bears a direct relationship with conditioning, the range of extinguishable behaviors is manifest. Its use as a systematic therapeutic strategy, as well as an explanation of human behavior, has been substantially documented in numerous journals. It has been successfully applied by both parents and other adults to numerous inappropriate behaviors exhibited by children; we will examine some of these studies.

It has been argued that there is no such thing as a pure extinction procedure (Etzel, LeBlanc, and Baer, 1977) because some other behavior is usually reinforced whether such is sytematically planned or not. However, there have been numerous studies in which one behavior, usually deemed inappropriate, has been put on extinction while another, more desired, behavior is consistently reinforced. Such a procedure often involves social rewards such as praise or eye contact and is consequently called differential attention.

In a 1968 study by Hall, Lund, and Jackson, the effects of teacher attention on studying time in elementary students were investigated. Thirty-minute daily observations were made to ascertain the students' baseline level of studying. Following this, the observer cued the teacher to attend to the child; such cues were given when the child was studying. The child was systematically ignored for not studying and disruption. The results of the procedure used with several students showed dramatic improvement in the rates of studying per observation period.

Attention span, defined as length of time on task and number of task changes made, has been seen to be an operant. Allen, Henke, Harris, Baer, and Reynolds (1967) instructed teachers to socially reinforce a four-year-old student only when he had been on the same task for one-minute. When he changed tasks, they were to immediately withdraw their attention until he had again been with one activity for a full minute. Within seven days, the number of activity changes made per day decreased markedly. In fact, extinction of all responding increases overall response level while the organism "looks for" a response that will be reinforced.

Bijou (1965) describes the successful use of extinction to decrease fantasy behavior in a boy described as "not knowing fantasy from reality." Praise and attention were withheld from such role-playing and given for appropriate play. Fantasy role playing decreased from a baseline rate of 40% to 3-4% following intervention; appropriate play increased from 35 to 60%. Such documentation of the effects of differential attention should help us to evaluate the appropriateness of our current strategies for dealing with the behaviorally disabled child.

The effectiveness of extinction in eliminating temper tantrums (crying, kicking, screaming) was initially documented in a 1962 study by Zimmerman and Zimmerman. The child's teacher systematically ignored his fits and selectively attended to proper behavior during English class. The eventual success of this approach was proven by the fact that the child no longer tantrumed during English but continued to do so in other classes in which the procedure had not been employed.

The generalized use of extinction is indicated by a study by Wolf, Birnbrauer, Williams, and Lawler (1965). The student involved was a nine-year old girl in a class for the mentally disabled who vomited every day in school. When this occurred, she was sent back to the dormitory for the rest of the day where she was cleaned and comforted. The authors hypothesized that vomiting was an operant which was reinforced by the opportunity to go to a more rewarding environment, the dormitory. During extinction, Laura remained in class for the entire day regardless of the amount of vomit that accumulated, and her teacher ignored this behavior. For the first 29 days of extinction, there were 78 occurrences of vomiting; there were 21 occurrences in one day. On day 30, however, vomiting ceased entirely and stayed at zero. Her teachers must be commended for their consistency and tenacity in using extinction to eliminate this behavior.

Pinkston, Reese, LeBlanc, and Baer (1973) demonstrated that extinction alone was successful in eliminating aggression in a 3 1/2-year-old boy. The teacher ignored the child who aggressed by rescuing and comforting the other child. Only when his instances of aggression were at an acceptable rate did they systematically reinforce peer interaction.

Williams (1959), in a classic study of extinction, consulted with the parents of a boy who demanded that they stay with him until he went to sleep. If they tried to leave, or even to do something other than attend to him, he would throw a temper tantrum. They began to systematically ignore the crying (he cried for 45-minutes the first night); on the tenth day, the child went to sleep without any fuss. Unfortunately, an aunt put the child to bed about a week later, and left the room. When he started to cry, the aunt came in and stayed with him until he slept. The next night, when put to bed, he cried for 50-minutes; it took another week for the parents to recoup the gains made by the initial extinction.

Many cases of wetting and soiling in older children are controlled by their social consequences. For example, Conger (1970) reported the case of an encopretic third-grader whose soiling was maintained by parental attention in the form of changing clothes and cleaning. It occurred between one and four times each day. On the first day, the mother was instructed to inform the child that he was a big boy who could take care of himself. Following this, and her systematic withdrawal of attention from the behavior, encopresis occurred only twice in the next 12 weeks (once on the first day of treatment).

Another study by Munford, Reardon, Liberman and Allen (1976) supports the notion that functional somatic disorders are operants. This case involved a 17-year-old girl who had displayed hysterical coughing at the rate of 40 to 50 coughs per minute for the last four years. Furthermore she had been electively mute for the last two years. She had received almost constant medical attention and intervention during that time, including electric aversive conditioning, to no avail. Systematic observation across settings revealed that, although of continual occurrence in her waking hours, the rate of coughing when she was aware of being observed was significantly higher than when she was alone doing a task. This suggested that the cough was an operant controlled by social consequences, and subsequent extinction of such reinforcement led to an eventual elimination of the hysteria.

Many studies have incorporated extinction with treatment strategies in addition to differential attention to effect behavioral change. Bernal, Duryee, Pruett, and Burns (1968) worked with a mother whose child (age 8 1/2) exerted almost total control over her. The boy threatened her with screaming, hitting, and asthma attacks if he did not get his way; usually the mother gave in. Furthermore he exhibited virtually no compliance with her requests. The authors taught her to selectively ignore his abusive behavior (from sulking to physical assault) and to reinforce instances of compliance. Punishment was used as a back-up to lend credence to the mother's commands, and all procedures were in a sequentially applied format.

Sajwaj, Twardosz, and Burke (1972) found that extinction was successful in reducing excessive conversations initiated by a student with his teacher. Simultaneous with this reduction, social behavior with peers increased as did disruptions during group activity. As was recommended in the previous section, disruption was treated as an inappropriate behavior and consequated with time-out. Obviously, extinction would <u>not</u> be indicated in the case of excessive conversations with peers. Withholding teacher attention from a behavior which is maintained by peer attention is not a case of withholding reinforcement. Some other strategy for intervention must be used.

Burgess incorporated extinction as an explanatory mechanism in depression. She suggested that depressed individuals were those whose performing behaviors were being extinguished while depressive behaviors selectively reinforced. The intervention she used, therefore, was extinction of depressive behaviors and reinforcement of performance. She found this to be an effective strategy in cases in which the reinstatement of the initial reinforcer could not be accomplished.

Whole response classes can be extinguished in a fashion similar to the single operant. Baer and Sherman (1964) taught several children to imitate and then gathered a measure of generalization. The imitative responses were then shown to be

extinguishable when social reinforcers were withheld for such performance. Thus modes of responding, as well as single operants, are able to be extinguished along the same dimensions. So, for example, complex responses such as cooperation and noncompliance can be selectively reinforced or extinguished when their delineating variables are well defined.

Given the problems implicit in the use of punishment, several studies have examined the use of extinction with self-abusive children. Jones, Simmons, and Frankel (1974) used two-hour daily sessions of noncontingent isolation as a forum for controlling the reinforcing contingencies for a self-abusive girl. Once the behavior had successfully been extinguished in that setting, it generalized to others. The social isolation sessions were gradually eliminated with no reappearance of self-destruction. Punishment had been attempted prior to extinction and had been unsuccessful; the issue of least restrictive alternative for treatment is obviously of consideration here. The determination of restrictability, in the case of punishment, must obviously incorporate a measure of rate of deceleration; such measures necessarily rely upon accurate reliable measures of frequency in order to assist in making beneficial treatment decisions.

In the case of the self-destructive children whose behavior was manipulated in the 1969 study by Lovaas and Simmons, rate of occurrence was used to decide that extinction was not an ideal procedure even though effective. Although one subject's self-destructive acts were extinguished to zero by the tenth session, a total of 9000 responses had been emitted, with 2750 during the first 1.5 hour session. Clearly, although the treatment was eventually successful, it resulted in vicious personal injury which did not occur when the behavior was punished.

Rincover (1978) has used a derivative of the traditional extinction procedure to eliminate self-stimulation in children who exhibit severe developmental disabilities. He hypothesized that the reinforcers maintaining the self-stimulation (plate spinning, finger flapping, and object manipulation) of three children were the auditory, visual, and proprioceptive stimuli they produced. Therefore, if such reinforcers were withheld, the behaviors should eventually be extinguished. Withholding reinforcement was accomplished by essentially masking the sensory effects of the responses. In the instances of auditory and preprioceptive feedback, the decreases in self-stimulation were remarkable; there was no change in rate of response given the masking of visual feedback. Although the study demonstrated the successful use of extinction, the author stressed caution in its use due to the idiosyncratic nature of sensory reinforcement.

The relative effectiveness of extinction has been systematically compared with many procedures. In addition to punishment, it has been evaluated in terms of overcorrection and

time-out. Matson, Stephens, and Horne (1978) compared extinction-reinforcement with overcorrection for disruption. They found that although overcorrection was more rapid in its effect and maintained the behavior at lower rates, the trainers themselves preferred extinction because it was more familiar, easier to learn, and required less effort.

Resistance to extinction of responses established given some variable of interest has become a source of information regarding aspects of learning. For example, Clarke (1973) found that subjects who received social reward showed significantly more resistance to extinction and late responses than did subjects who received nonsocial reward. Levine (1976) found an inverse relationship between IQ and resistance to extinction in groups of students who exhibited mental disabilities. Varying reports on the relationship between conditionability, resistance to extinction, and age have drawn no clear conclusions. Given that responding maintained by CRF is less resistant to extinction than responding maintained by intermittent reinforcement, several authors have suggested reinforcing an undesired response continuously prior to extinction to facilitate speed of deceleration. However, the support for such a procedure has been equivocal. Although Glavin and Moyer (1975) found this effective in reducing infant crying, LeBlanc (1977) found little to support such an approach. Given the variability in technique, responses, and subject population, a more systematic evaluation must be made before any serious conclusions can be drawn.

In short, extinction has been and can be used for a wide range of both appropriate and inappropriate human behavior; other studies not mentioned have demonstrated its applicability in changing racial attitudes, insomnia, deviant sex role behaviors, extreme passivity, delusional speech, and echolalia. Essentially, all extinction procedures share two common elements: systematic, consistent withdrawal of reinforcement (often attention) from undesired behavior and reinforcement of some other incompatible desireable behavior.

Implications for the School Psychologist

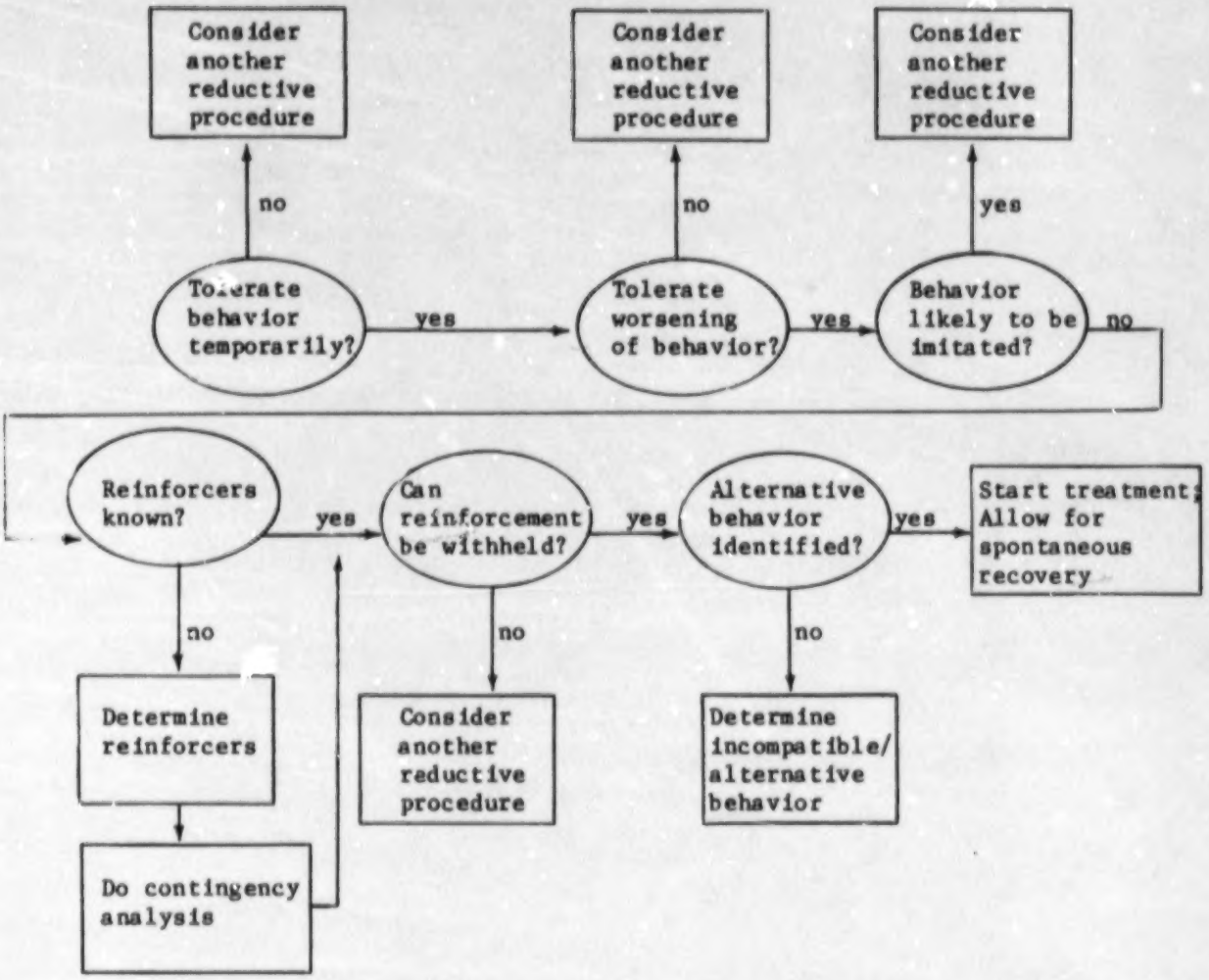
Extinction, as an intrinsic property of the conditioning process that produced the behavior, has been seen to have extensive therapeutic applications. Not only can it be specifically applied to the wide range of human response, but it is an element of almost all other paradigms of behavior change.

We have stressed the application of extinction by the direct service agent, the teacher. However, the manner of such implementation must necessarily be guided by outside personnel

who are able to objectively observe and analyze the behavioral interaction and who are aware of the scientific aspects of "ignoring." It is the job of such consultants to impart their expertise in such ways as to ensure teacher compliance rather than sabotage. In this regard, it is as important to use conditioning and extinction to achieve and maintain that compliance, and eliminate noncompliance, as it is to recommend the implementation of sound psychological procedures for their students. A great program, which is never used or inaccurately implemented, is as good as (or worse than) no program at all.

However, the principle doesn't stop working just because it is not systematically programmed, and we, as psychologists, must be aware of its permeability in all facets of behavior. Whether we are aware of the contingencies we invoke or not, they are still in effect; behaviors are being reinforced, extinguished, and punished regardless of our systematic intent. As counselors or psychological therapists, therefore, we too must exercise caution in reinforcing inappropriate client behavior. Conversely, it is crucial to reinforce the socially appropriate responses they make, especially in clients who exhibit deviant or nonaffective behaviors. If we do not, we may be guilty of maintaining the need for intervention rather than eliminating it. Only by the analysis of interactions and contingencies - between therapist and client as well as others - will we be able to effectively predict behavior, and thus control it.

Appendix I



---Benoit and Mayer, 1974

Footnotes

1. A. Charles Catana, Learning, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1979, p. 82.

2. J. R. Millenson, Principles of Behavioral Analysis, The Macmillan Company, New York, 1967, p. 363.

3. I. P. Pavlov, Conditioned Reflexes, Dover Publications, Inc., New York, 1927, p. 61.

4. David Krech, Richard Crutchfield, and Norman Livson, Elements of Psychology, Alfred A. Knopf, New York, 1974, p. 620.

5. Catania, p. 79.

6. G. S. Reynolds. A Primer of Operant Conditioning, Scott, Foresman, and Company, Glenview, Illinois, 1975, p. 84.

7. Howard Rachlin, Introduction to Modern Behaviorism, W. H. Freeman and Company, San Francisco, 1970, p. 117.

8. C. B. Ferster, Stuart Culbertson, and Mary Carol Perrott Boren, Behavior Principles, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1975, p. 49.

9. C. B. Ferster and B. F. Skinner, Schedules of Reinforcement, Appleton-Century-Crofts, Inc., New York, 1957, p. 8.

10. Millenson, p. 363.

11. James Johnston, Controlling the use of punishment. In Krapfl, John E. and Vargas, Ernest A., Eds. Behaviorism and Ethics Behaviordelia, Kalamazoo, Michigan, 1977, p. 124.

12. Ferster et. al., p. 191.

13. Ralph O. Blackwood, Operant Control of Behavior, Exordium Press, Akron, Ohio, 1971, p. 4-6.

References

Allen, K. Eileen, Henke, Lydia B., Harris, Florence R., Baer, Donald M., and Reynolds, Nancy J. control of hyperactivity by social reinforcement of attending behavior. Journal of Educational Psychology, 1967, 58, 4, 231-237.

Axelrod, Saul. Behavior Modification for the Classroom Teacher. New York: McGraw-Hill Book Co., 1977.

Baer, Donald M., and Sherman, James. Reinforcement control of generalized imitation in young children, Journal of Experimental Child Psychology, 1964, 1, 37-49.

Benoit, Robert B., and Mayer, G. Ray. Extinction: Guidelines for its selection and use, Personnel and Guidance Journal, 1974, 52, 5, 290-294.

Bernal, Martha E., Duryee, John S., Pruett, Harold L.; and Burns, Beverlee J. Behavior modification and the brat syndrome, Journal of Consulting and Clinical Psychology, 1968, 32, 447-455.

Bijou, S.W. Implications of behavior science for counseling and guidance. Paper read at The Cubberley Conference, Stanford University, California, July, 1965.

Blackwood, Ralph O. Operant Control of Behavior. Akron, Ohio: Exordim Press, 1971.

Broughton, Sam. The unwitting behavior modifier, Elementary School Journal, 1974, 75, 3, 143-151.

Burgess Elaine. The modification of depressive behaviors. In Rubin, Richard D., and Franks, Cyril M. Advances in Behavior Therapy, 1968, New York: Academic Press, 1969.

Cahoon, D. D., and Wenrich, W. W. Note on behavior modification using extinction and counterconditioning procedures. Psychological Record, October, 1965, 535-536.

Catania, A. Charles. Learning. Englewood Cliffs, N.J.: Prentice-Hall, Inc. 1979.

Cermak, Laird S. Human Memory: Research and Theory. New York: The Ronald Press Co., 1972.

Clarke, Alex M. Instrumental learning in young children, New Guinea Psychologist, 1973, 5, 64-66.

Conger, Judy Cohen. The treatment of encopresis by the management of social consequences, Behavior Therapy, 1970, 1, 386-390.

References

Drabman, Ronald S., Jarvie, Gregory J., and Archbold, James. The use and misuse of extinction in classroom behavioral programs, Psychology in the Schools, 1976, 13, 4, 470-476.

Etzel, Barbara C., LeBlanc, Judith M., and Baer, Donald M., Eds. New Developments in Behavioral Research. Hillsdale, N.J.: Lawrence Erlbaum Associates Publishers, 1977.

Ferster, C. B., Culbertson, Stuart, and Boren, Mary Carol Perrott, Behavior Principles. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1975.

Ferster, C. B., and Skinner, B. F. Schedules of Reinforcement. New York: Appleton-Century-Crofts, Inc., 1957.

Gilbert, Grant O. Extinction procedures: proceed with caution, Mental Retardation, 1975, 13, 28-29.

Glavin, John P., and Moyer, Linda S. Facilitating extinction of infant crying by changing reinforcement schedules, Journal of Behavior Therapy and Experimental Psychiatry, 1975, 6, 357-358.

Hall, R. Vance, Lund, Diane; and Jackson, Deloris. Effects of teacher attention on study behavior. Journal of Applied Behavior Analysis, 1968, 1, 1-12.

Haring, Norris G., and Phillips, E. Larkin. Analysis and Modification of Classroom Behavior. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1972.

Harris, Mary B. Classroom Uses of Behavior Modification. Columbus, Ohio: Charles E. Merrill Publishing Co., 1972.

Hilgard, Ernest R., and Bower, Gordon H. Theories of Learning. New York: Appleton-Century-Crofts, 1966.

Hilgard, Ernest R., and Marquis. Conditioning and Learning. New York: Appleton-Century-Crofts, 1961.

Johnston, James. Controlling the use of punishment. In Krapfl, Jon E. and Vargas, Ernest A., Eds. Behaviorism and Ethics. Kalamazoo, Michigan: Behaviordelia, 1977.

Jones, Fredric H., Simmons, James Q., and Frankel, Frederick. An extinction procedure for eliminating self-destructive behavior in a 9-year-old girl, Journal of Autism and Childhood Schizophrenia, 1974, 4, 3, 241-250.

Jung, John. Verbal Learning. New York: Holt, Rinehart, and Winston, Inc., 1968.

Krech, David, Crutchfield, Richard, and Livson, Norman. Elements of Psychology. New York: Alfred A. Knopf, 1974.

Levine, B. A. Resistance to extinction as a function of IQ and reinforcement ratio among retarded children, Journal of Mental Deficiency Research, 1976, 20, 25-30.

Lovaas, O. Ivar, and Simmons, James Q. Manipulation of self-destruction in three retarded children, Journal of Applied Behavior Analysis, 1969, 2, 143-157.

Madsen, Charles H., Becker, Wesley C., Thomas, Don R., Koser, Linda, and Plager, Elaine. An analysis of the reinforcing function of "Sit-Down" commands. In Harris, Mary B., Classroom Uses of Behavior Modification. Columbus, Ohio: Charles E. Merrill Pub. Co., 1972.

Madsen, C. H., Madsen, C. K., and Driggs, D. F. Freeing teachers to teach. In Rickard, H. C., Ed. Behavioral Intervention in Human Problems. New York: Pergamon Press, 1971.

Martin, Reed. Legal Challenges to Behavior Modification. Champaign, Illinois: Research Press, 1975.

Martin, Reed, and Lauridsen, David. Developing Student Discipline and Motivation. Champaign, Illinois: Research Press, 1974.

Millenson, J. R. Principles of Behavioral Analysis. New York: The Macmillan Co., 1967.

Mischel, Walter. Personality and Assessment. New York: John Wiley and Sons, Inc., 1968.

Munford, Paul R., Reardon, Diane, Liberman, Robert P., and Allen, Linda. Behavioral treatment of hysterical coughing and mutism: a case study, Journal of Consulting and Clinical Psychology, 1976, 44, 1008-1014.

Pavlov, I. P. Conditioned Reflexes, New York: Dover Publications, Inc., 1927.

Pinkston, Elsie M., Reese, Nancy M., LeBlanc, Judith M., and Baer, Donald M. Independent control of a preschool child's aggression and peer interaction by contingent teacher attention, Journal of Applied Behavior Analysis, 1973, 6, 115-124.

Pitts, Carl E. Introduction to Educational Psychology. New York: Thomas Y. Crowell Co., 1971.

Rachlin, Howard. Introduction to Modern Behaviorism. San Francisco: W. H. Freeman and Co., 1970.

Rachlin, Howard. Behavior and Learning. San Francisco: W. H. Freeman and Co., 1976.

Redd, William H. Attention span and generalization of task-related stimulus control: effects of reinforcement contingencies, Journal of Experimental Child Psychology, 1972, 13, 527-539.

Reese, Ellen P. The analysis of Human Operant Behavior. Dubuque, Ia.: William C. Brown Co., 1966.

Reynolds, G. S. A Primer of Operant Conditioning. Glenview, Ill.: Scott, Foresman and Co., 1975.

Rincover, Arnold. Sensory extinction: a procedure for eliminating self-stimulatory behavior in developmentally disabled children, Journal of Abnormal Child Psychology, 1978, 6, 299-310.

Sajwaj, Thomas; Twardosz, Sandra; and Burke, Marianne. Side effects of extinction procedures in a remedial preschool, Journal of Applied Behavior Analysis, 1972, 5, 163-175.

Skinner, B. F. The Behavior of Organisms. New York: Appleton-Century-Crofts, 1938.

Skinner, B. F. Science and Human Behavior. New York: The Macmillan Co., 1953.

Skinner, B. F. Verbal Behavior. Englewood Cliffs, N.J.: Prentice-Hall, Inc.

Sloane, Howard N. Classroom Management. John Wiley and Sons, Inc., 1976.

Sprague, Joseph E., Fixsen, Dean L., and Girarbeau, Frederic L. Reinstatement of an operant response by the delivery of reinforcement during extinction, Journal of Experimental Child Psychology, 1969, 7, 96-100.

Stevenson, Harold W. Learning and reinforcement effects. In Spencer, Thomas D., and Kass, Norman, Perspectives in Child Psychology. New York: McGraw-Hill Book Co., 1970.

Ulrich, Roger, Stachnik, Thomas, and Mabry, John, Eds. Control of Human Behavior, Vol. I. Glenview, Ill: Scott, Foresman and Co., 1966.

Ulrich, Roger, Stachnik, Thomas, and Mabry, John, Eds. Control of Human Behavior, Vol. II. Glenview, Ill: Scott, Foresman and Co., 1970.

Whaley, Donald L, and Malott, Richard W. Elementary Principles of Behavior. New York: Appleton-Century-Crofts, 1971.

Williams, C.D. The elimination of tantrum behavior by extinction procedures, Journal of Abnormal and Social Psychology, 1959, 59, 269.

Woody, Robert H. Behavior therapy and school psychology, Journal of School Psychology, 1966, 4, 1-14.

Zimmerman, E. H., and Zimmerman, J. The alteration of behavior in a special classroom situation, Journal of the Experimental Analysis of Behavior, 1962, 5, 59-60.